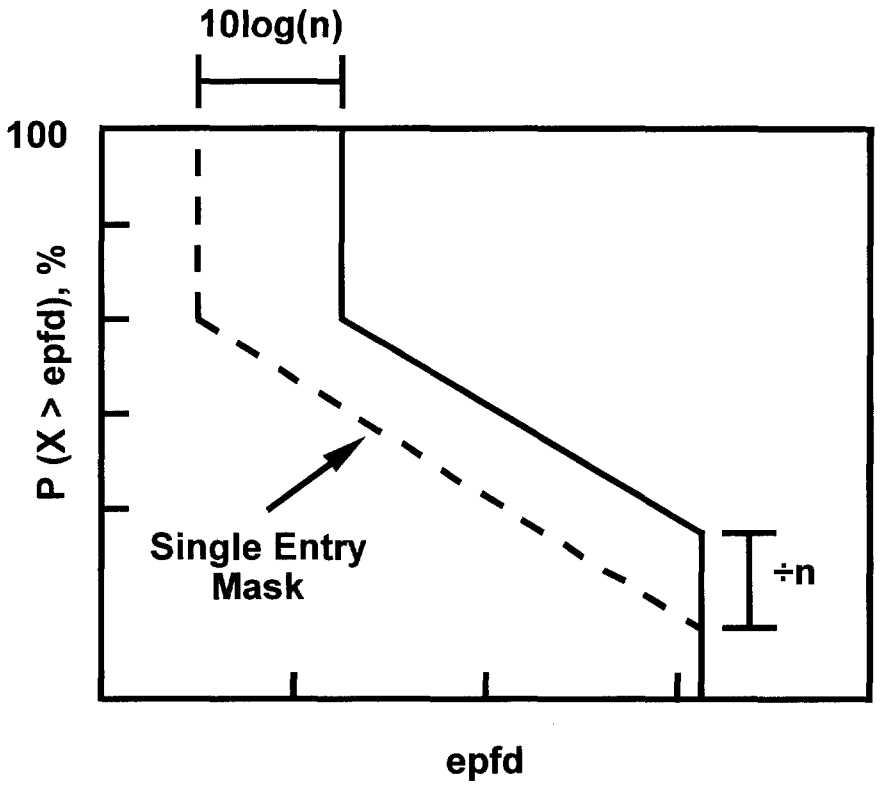

Figure 7.3.-1 Single-Entry epfd Mask Derived From Aggregate epfd Mask

8 Proposed epfd Limits

Aggregate and single entry epfd masks have been generated by DIRECTV that meet the criteria given in the PDNR. They were developed to protect BSS systems using 45 cm, 60 cm, 90 cm, 120 cm, 180cm, and 240 cm earth station antennas. As noted above, many solutions that satisfy the criteria in the PDNR are possible. These solutions take the form of alternate mask shapes. Adjustments to the shape are more easily made to the long-term portion of the curve and much less easily made in the short-term portion of the curve. The masks presented here fully protect the BSS links listed in Annex 1. The links identified as USGSO 15, 16, 17, 18 and 19 will be submitted within a short period of time to the JWP 10-11S Special Rapporteur for consideration in the JTG 4-9-11 discussions. These links protect service to Alaska and Hawaii.

The proposed masks are provided in sections 8.1 to 8.6. As a result of technical discussion within JTG 4-9-11, the number of equivalent NGSO FSS systems that are anticipated to share the same frequency band has been reduced to the range of 3 to 5 systems. In order to ensure protection of BSS systems, the effective number of NGSO systems that can share the same frequency band is assumed herein to be 5. Single entry masks are derived from the aggregate masks using this value of 5.

These Monte Carlo calculations do not include fading of the NGSO interference by rain (as was agreed to during JTG 4-9-11 deliberations). These calculations also do not include the increase of the receive system noise temperature by "gaseous attenuation," a factor which was first discussed at the January 1999 meeting.

8.1 45 cm Antenna Aggregate and Single Entry EPFD Masks

Figure 8.1-1 illustrates the proposed masks to protect 45 cm BSS earth station antennas. An aggregate mask, a single entry mask, and the single entry provisional limit mask are all shown. This mask protects the most sensitive 45 cm antenna link found in Annex 1, which is link US-GSO D4.

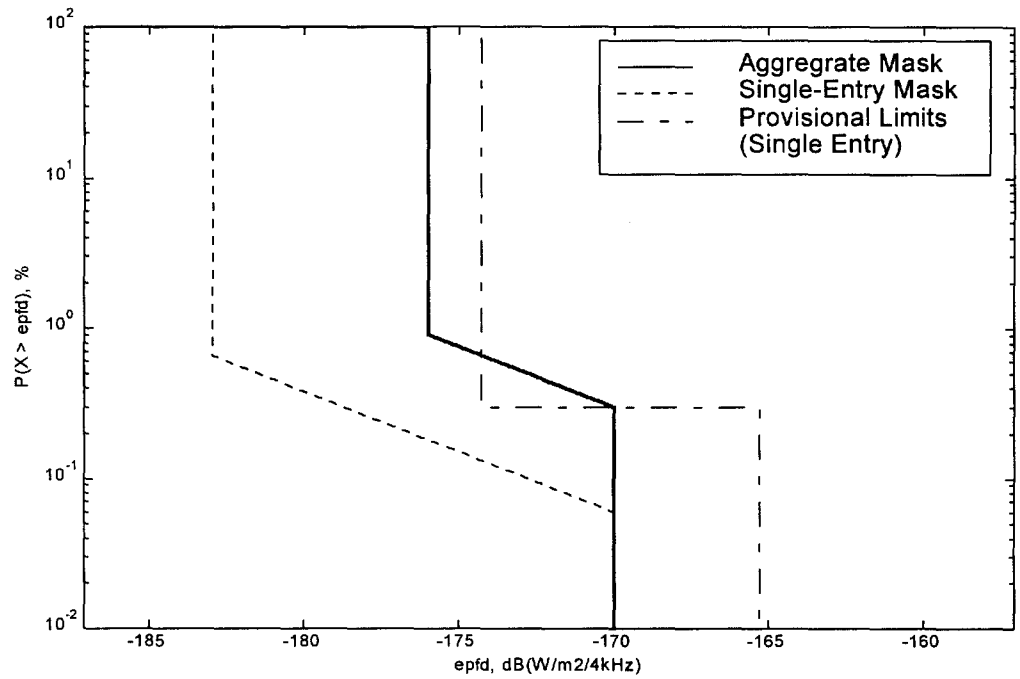

Figure 8.1-1: Proposed epfd Masks, 45 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask All NGSO Systems	
epfd dBW/m^2/4kHz	P (X<epfd), %
-176	99.10%
Slope = -12.5 dB/decade to –170	
-170	99.70%
-170	100%

Table 8.1-1: Proposed Aggregate Mask, 45 cm Antenna

Single Entry Mask	
epfd dBW/m^2/4kHz	P (X<epfd), %
-183	99.34%
Slope = -12.5 dB/decade to –170	
-170	99.94%
-170	100%

Table 8.1-2: Proposed Single Entry Mask, 45 cm Antenna

Figure 8.1-2 shows the result of the evaluation of the proposed aggregate mask when applied to the US-GSO D4 BSS link against the 10% degradation in unavailability criterion.

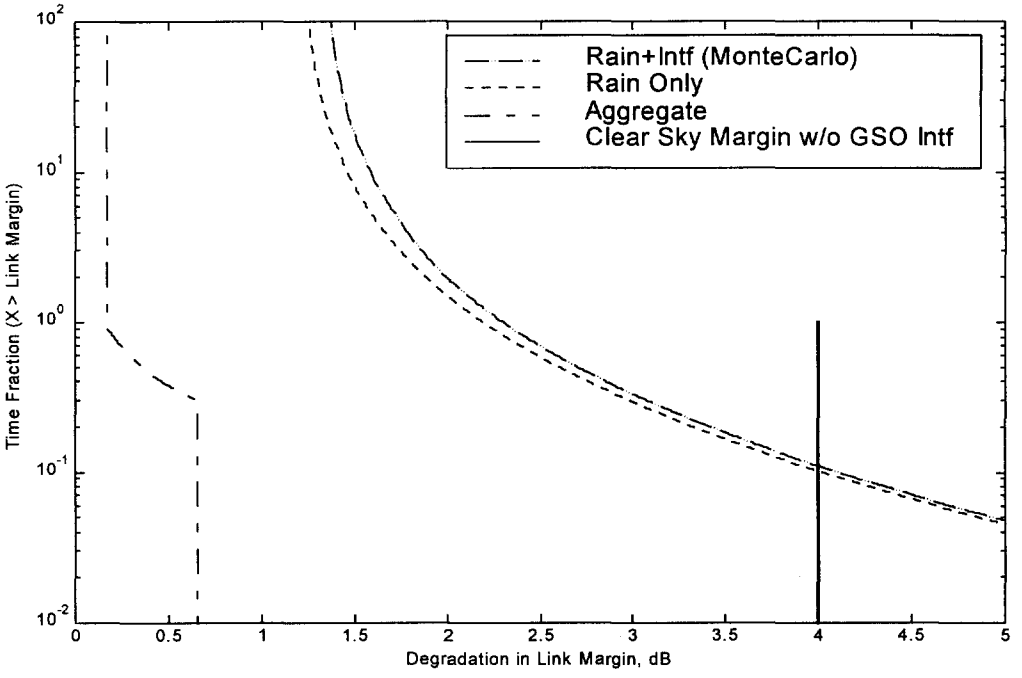

Figure 8.1-2: Evaluation of Aggregate NGSO Interference Mask on US-GSO D4 Link

The vertical line at about 4 dB represents the amount of degradation that can be suffered in the US-GSO D4 link before the signal falls below the required minimum C/(N+I) value. The top two curves represent the fraction of time that a particular link margin is exceeded with and then without aggregate NGSO interference. The link is unavailable when the degradation exceeds the degradation available in the link budget. The degradation used in the Monte Carlo program for each link is calculated with respect to the noise level before adjacent satellite GSO BSS interference, adjacent satellite FSS interference, and uplink effects are included (see equation 7 in Annex 2). For this reason, the degradation permissible for the US-GSO D4 link is slightly higher than the clear sky margin shown in the link budgets in Annex 1.

The change in unavailability at the 4-dB point in Figure 8.1-2 for the proposed aggregate mask is 9.2%, meeting the 10% criteria of the PDNR. This increase in unavailability is calculated by taking the difference between the link unavailability with rain plus NGSO interference and with rain only, and then dividing by the unavailability with rain only.

Table 8.1-3 shows the result of the evaluation of the short-term epfd limit value in the proposed aggregate mask when applied to the US-GSO D4 BSS link against the 'no loss of synchronization' criterion.

1	NGSO epfd	dB(W/m2/4kHz)	-170
2			USA
3	**BSS Assignment characteristics**	**Units**	**US-GSO D4**
4	**System Characteristics**		
5	Frequency	GHz	12.700
6	Availability objective	%	99.90
7	**Calculated availability due to rain up and downlink (Rec P 618-5)**	%	
8	**Calculated availability due to rain downlink (Rec P 618-5)**	%	
9	**Calculated availability due to rain uplink (Rec P 618-5)**	%	
10	Receiver noise Bandwidth	MHz	24
11	Modulation type		8PSK
12	C/I due to other GSO BSS networks	dB	20
13	***C/I due to NGSO FSS networks***	dB	23.6
14	*Clear sky feeder link C/N+I*	*dB*	*24.2*
15	C/N+I required at operating threshold	dB	9.5
16	Clear sky C/N+I margin above operating threshold (1)	dB	3.9
17	**Total Clear sky C/N+I margin above operating threshold (1)**	dB	
18	**Available clear sky downlink rain margin above threshold**	dB	
19	**Available clear sky uplink rain margin above threshold**	dB	
20	C/N+I total link for 99.7% of the time	dB	
21	C/N+I margin above operating threshold for 99.7% of the time	dB	2.2
22	C/N+I total link margin above operating threshold for 99.7% of the time	dB	
23	**Space station characteristics**		
24	Longitude	°	101W
25	Satellite e.i.r.p. in the direction of the earth station	dBW	54.1
26	**Earth station characteristics**		
27	Receive antenna diameter	cm	45
28	*Receive antenna efficiency*	*%*	*70*
29	On-axis antenna gain at receiver input	dBi	34
30	**On-axis antenna gain at antenna output**	**dBi**	
31	Off-axis antenna gain characteristics		App 30, An. 5
32	Clear sky receive system noise temperature at receiver input	K	125
33	Clear sky receive system noise temperature at antenna output	K	
34	*Clear sky G/T*	*dB/K*	*13*
35	Total pointing loss	dB	0.5
36	Location of earth station		
37	Latitude	°	47.6
38	Longitude	°	122.3W
39	Altitude	km	
40	Rain climatic zone		D
41	Elevation angle	°	31.5
42	**Propagation characteristics**		
43	*Slant path*	*km*	*38500*
44	*Free space loss*	*dB*	*206.2*
45	*Atmospheric absorption*	*dB*	*0.2*
46	Rain attenuation for 99.7% of the time	dB	0.80
47	*Noise increase due to rain for 99.7 % of the time*	*dB*	*1.4*
48	Wanted pfd received at earth station	dB(W/m2)	
49	Rain attenuation for availability percentage of time	dB	1.32
50	*Noise increase due to rain for availability percentage of time*	*dB*	*2.1*
51	**Downlink budget clear sky**		
52	*C/N thermal clear sky downlink*	*dB*	*15.0*
53	*C/N+I clear sky downlink*	*dB*	*13.4*
54	*C/N+I clear sky total link*	*dB*	*13.0*
55	Clear sky C/N downlink margin above operating threshold	dB	5.5
56	Clear sky C/N+I downlink margin above operating threshold	dB	3.9
57	Clear sky C/N+I total margin above operating threshold	dB	3.5

Table 8.1-3 'Loss of sync' calculation for link US-GSO D4

8.2 60 cm Antenna Aggregate and Single Entry EPFD Masks

Figure 8.2-1 illustrates the proposed masks to protect 60 cm BSS earth station antennas. An aggregate mask and a single entry mask are all shown (a provisional limit is not specified in Region 2 for this antenna size). This mask protects the most sensitive 60 cm antenna link found in Annex 1, which is link CAN-5.

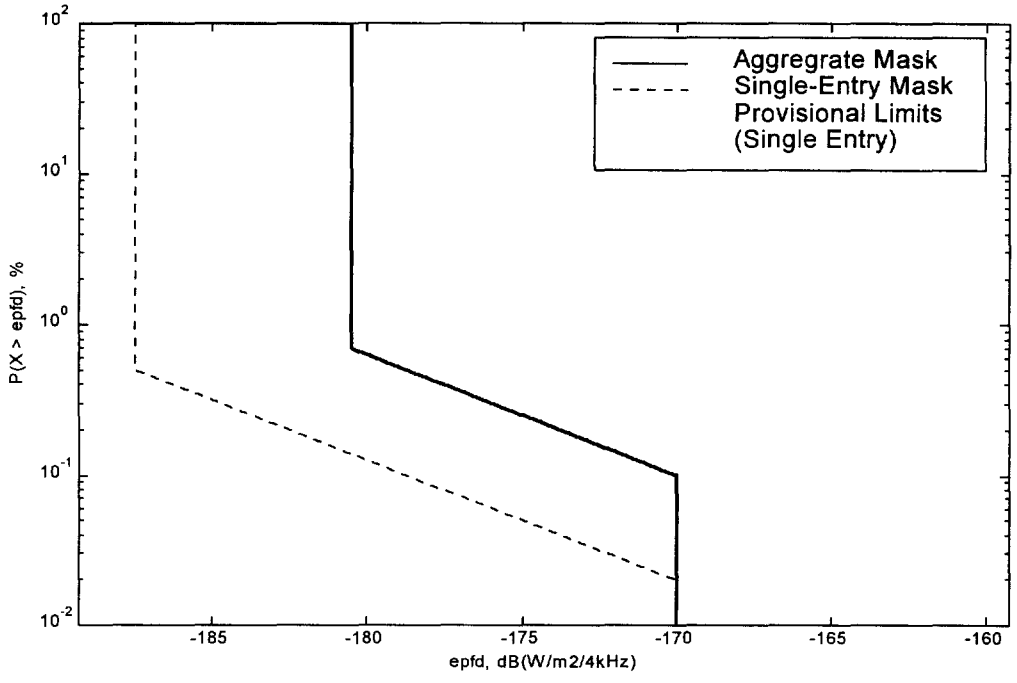

Figure 8.2-1: Proposed epfd Masks, 60 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask **All NGSO Systems**	
epfd dBW/m^2/4kHz	P (X<epfd), %
-181	97.73%
Slope = -12.5 dB/decade to –170	
-170	99.70%
-170	100%

Table 8.2-1: Proposed Aggregate Mask, 60 cm Antenna

Single Entry Mask	
epfd dBW/m^2/4kHz	P (X<epfd), %
-188	98.36%
Slope = -12.5 dB/decade to –170	
-170	99.94%
-170	100%

Table 8.2-2: Proposed Single Entry Mask, 60 cm Antenna

Figure 8.2-2 shows the result of the evaluation of the proposed aggregate mask when applied to the CAN-5 BSS link.

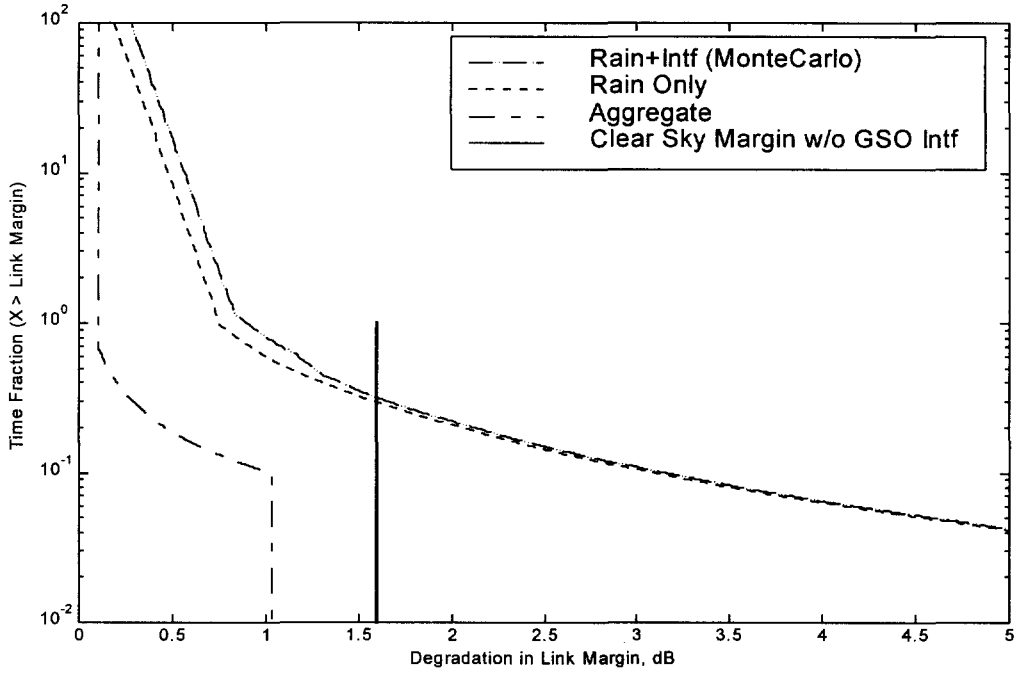

Figure 8.2-2: Evaluation of Aggregate NGSO Interference Mask on CAN-5 link

The vertical line at about 1.6 dB represents the amount of degradation that can be suffered in the CAN-5 link before the signal falls below the required minimum C/(N+I) value. The change in unavailability at this point for the proposed aggregate mask is 9.4%, meeting the 10% criteria of the preliminary draft new recommendation.

Table 8.2-3 shows the result of the evaluation of the short-term epfd limit value in the

proposed aggregate mask when applied to the CAN-5 BSS link against the 'no loss of synchronization' criterion.

1	NGSO epfd	dB(W/m2/4kHz)	-170
2			Canada
3	**BSS Assignment characteristics**	**Units**	**CAN-5**
4	**System Characteristics**		
5	Frequency	GHz	12.500
6	Availability objective	%	99.7040
7	Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.7040
8	Calculated availability due to rain downlink (Rec P 618-5)	%	99.7100
9	Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940
10	Receiver noise Bandwidth	MHz	24
11	Modulation type		QPSK
12	C/I due to other GSO BSS networks	dB	21.9
13.0	C/I due to GSO FSS networks	dB	14.1
14	Clear sky feeder link C/N+I	dB	25.7
15	C/N+I required at operating threshold	dB	6.6
16	Clear sky C/N+I margin above operating threshold (1)	dB	
17	**Total Clear sky C/N+I margin above operating threshold (1)**	dB	0.4
18	**Available clear sky downlink rain margin above threshold**	dB	0.5
19	**Available clear sky uplink rain margin above threshold**	dB	19.1
20	C/N+I total link for 99.7% of the time	dB	5.9
21	C/N+I margin above operating threshold for 99.7% of the time	dB	
22	C/N+I total link margin above operating threshold for 99.7% of the time	dB	-0.7
23	**Space station characteristics**		
24	Longitude	°	-82
25	Satellite e.i.r.p. in the direction of the earth station	dBW	44.5
26	**Earth station characteristics**		
27	Receive antenna diameter	cm	60
28	Receive antenna efficiency	%	65
29	On-axis antenna gain at receiver input	dBi	
30	**On-axis antenna gain at antenna output**	**dBi**	36.00
31	Off-axis antenna gain characteristics		Footnote 3
32	Clear sky receive system noise temperature at receiver input	K	
33	Clear sky receive system noise temperature at antenna output	K	123
34	Clear sky G/T	dB/K	15.1
35	Total pointing loss	dB	0.0
36	Location of earth station		
37	**Latitude**	°	**39.72**
38	**Longitude**	°	**-105.02**
39	Altitude	km	0
40	Rain climatic zone		B
41	Elevation angle	°	38.2
42	**Propagation characteristics**		
43	Slant path	km	37917
44	Free space loss	dB	206.0
45	Atmospheric absorption	dB	0.2
46	Rain attenuation for 99.7% of the time	dB	0.49
47	Noise increase due to rain for 99.7 % of the time	dB	0.97
48	Wanted pfd received at earth station	dB(W/m2)	*-118.8*
49	Rain attenuation for availability percentage of time	dB	0.50
50	Noise increase due to rain for availability percentage of time	dB	1.0
51	**Downlink budget clear sky**		
52	C/N thermal clear sky downlink	dB	8.2
53	C/N+I clear sky downlink	dB	7.1
54	C/N+I clear sky total link	dB	7.0
55	Clear sky C/N downlink margin above operating threshold	dB	1.6
56	Clear sky C/N+I downlink margin above operating threshold	dB	0.5
57	Clear sky C/N+I total margin above operating threshold	dB	0.4

Table 8.2-3 'Loss of sync' calculation for link CAN5

8.3 120 cm Antenna Aggregate and Single Entry EPFD Masks

Figure 8.3-1 illustrates the proposed masks to protect 120 cm BSS earth station antennas. An aggregate mask, a single entry mask, and the single entry provisional limit mask are all shown. This mask protects the most sensitive 120 cm antenna link found in Annex 1, which is link US-GSO D15. For the United States, this link provides primary DIRECTV service to large portions of Alaska.

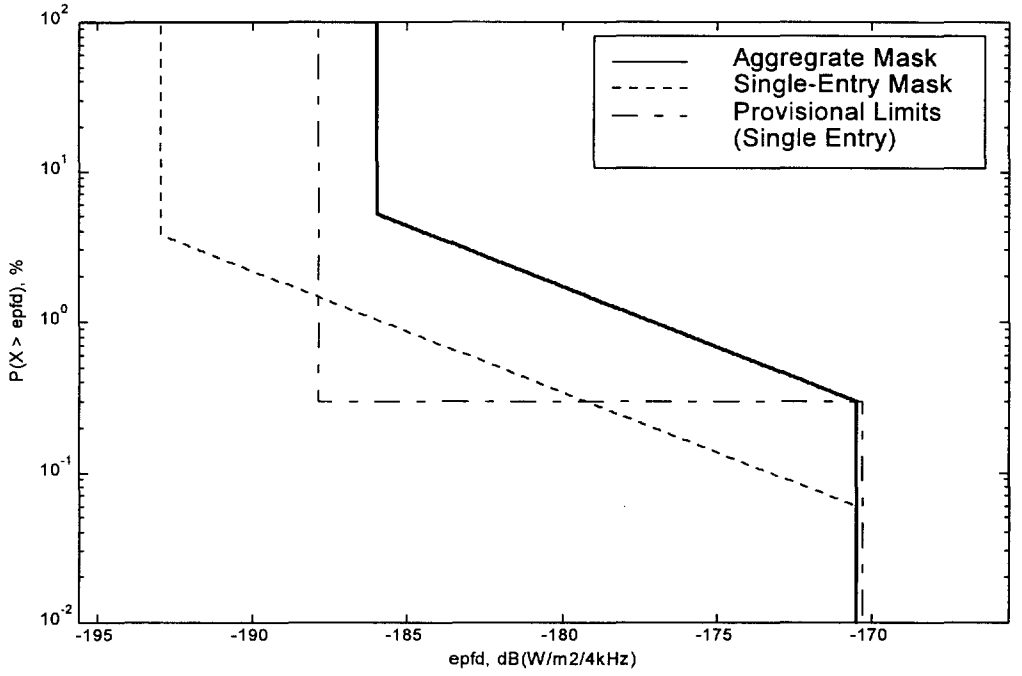

Figure 8.3-1: Proposed epfd Masks, 120 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask All NGSO Systems	
epfd dBW/m^2/4kHz	P (X<epfd), %
-186	94.80%
Slope = -12.5 dB/decade to –170.5	
-170.5	99.70%
-170.5	100%

Table 8.3-1: Proposed Aggregate Mask, 120 cm Antenna

Single Entry Mask	
epfd dBW/m^2/4kHz	P (X<epfd), %
-192.99	96.23%
Slope = -12.5 dB/decade to –170.5	
–170.5	99.94%
–170.5	100%

Table 8.3-2: Proposed Single Entry Mask, 120 cm Antenna

Figure 8.3-2 shows the result of the evaluation of the proposed aggregate mask when applied to the US-GSO D15 BSS link.

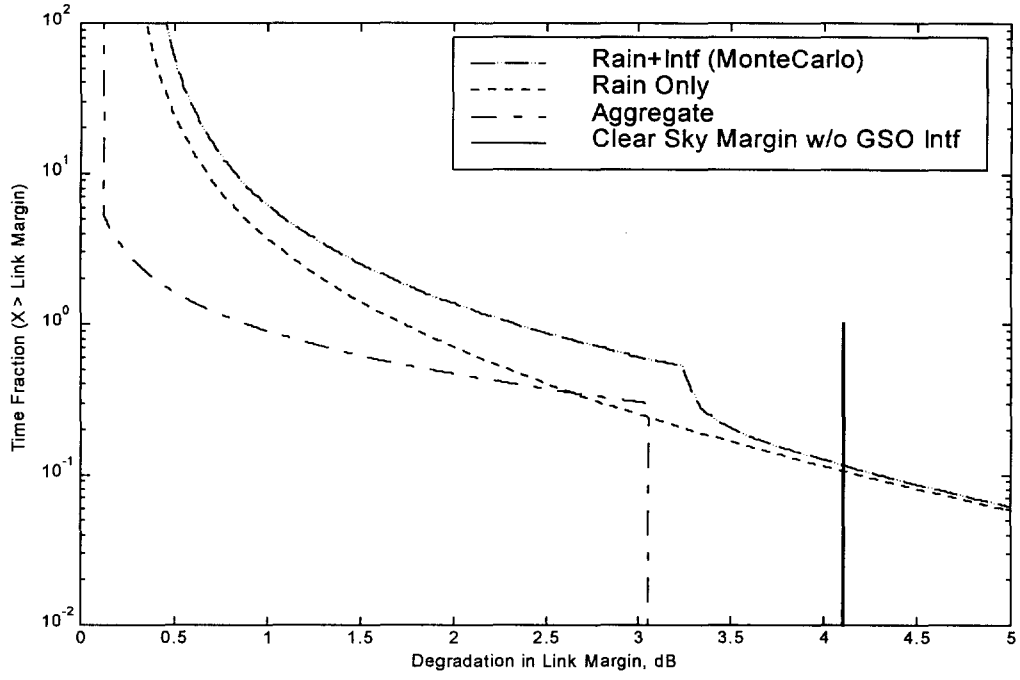

Figure 8.3-2: Evaluation of Aggregate NGSO Interference Mask on US-GSO D15 link

The vertical line at about 4.1dB represents the amount of degradation that can be suffered in the US-GSO D15 link before the signal falls below the required minimum C/(N+I) value. The change in unavailability at this point for the proposed aggregate mask is 9.8%, meeting the 10% criteria of the preliminary draft new recommendation.

Table 8.3-3 shows the result of the evaluation of the short-term epfd limit value in the proposed aggregate mask when applied to the US-GSO D15 BSS link against the 'no loss of synchronization' criterion.

1	NGSO epfd	dB(W/m2/4kHz)	-170.5
2			USA
3	**BSS Assignment characteristics**	**Units**	**US-GS0 D15**
4	**System Characteristics**		
5	Frequency	GHz	12.7
6	Availability objective	%	99.90
7	**Calculated availability due to rain up and downlink (Rec P 618-5)**	%	
8	**Calculated availability due to rain downlink (Rec P 618-5)**	%	
9	**Calculated availability due to rain uplink (Rec P 618-5)**	%	
10	Receiver noise Bandwidth	MHz	24
11	Modulation type		QPSK
12	C/I due to other GSO BSS networks	dB	23.7
13	***C/I due to NGSO FSS networks***	dB	13.1
14	*Clear sky feeder link C/N+I*	*dB*	*24.2*
15	C/N+I required at operating threshold	dB	6.1
16	Clear sky C/N+I margin above operating threshold (1)	dB	3.1
17	**Total Clear sky C/N+I margin above operating threshold (1)**	dB	
18	**Available clear sky downlink rain margin above threshold**	dB	
19	**Available clear sky uplink rain margin above threshold**	dB	
20	C/N+I total link for 99.7% of the time	dB	
21	C/N+I margin above operating threshold for 99.7% of the time	dB	1.4
22	C/N+I total link margin above operating threshold for 99.7% of the time	dB	
23	**Space station characteristics**		
24	Longitude	°	101W
25	Satellite e.i.r.p. in the direction of the earth station	dBW	43.1
26	**Earth station characteristics**		
27	Receive antenna diameter	cm	120
28	*Receive antenna efficiency*	*%*	*70*
29	On-axis antenna gain at receiver input	dBi	42.5
30	**On-axis antenna gain at antenna output**	**dBi**	
31	Off-axis antenna gain characteristics		App 30, An. 5
32	Clear sky receive system noise temperature at receiver input	K	125
33	Clear sky receive system noise temperature at antenna output	K	
34	*Clear sky G/T*	*dB/K*	*22*
35	Total pointing loss	dB	0.5
36	Location of earth station		
37	Latitude	°	57.0
38	Longitude	°	-134.5
39	Altitude	km	
40	Rain climatic zone		D
41	Elevation angle	°	17.8
42	**Propagation characteristics**		
43	*Slant path*	*km*	*38500*
44	*Free space loss*	*dB*	*206.2*
45	*Atmospheric absorption*	*dB*	*1.0*
46	Rain attenuation for 99.7% of the time	dB	1.0
47	*Noise increase due to rain for 99.7 % of the time*	*dB*	*1.7*
48	Wanted pfd received at earth station	dB(W/m2)	
49	Rain attenuation for availability percentage of time	dB	1.63
50	*Noise increase due to rain for availability percentage of time*	*dB*	*2.4*
51	**Downlink budget clear sky**		
52	*C/N thermal clear sky downlink*	*dB*	*11.7*
53	*C/N+I clear sky downlink*	*dB*	*9.2*
54	*C/N+I clear sky total link*	*dB*	*9.1*
55	Clear sky C/N downlink margin above operating threshold	dB	5.6
56	Clear sky C/N+I downlink margin above operating threshold	dB	3.1
57	Clear sky C/N+I total margin above operating threshold	dB	3.0

Table 8.3-3 'Loss of sync' calculation for link US-GSO D15

8.4 180 cm Antenna Aggregate and Single Entry EPFD Masks

Figure 8.4-1 illustrates the proposed masks to protect 180 cm BSS earth station antennas. An aggregate mask, a single entry mask, and the single entry provisional limit mask are all

shown. This mask protects the most sensitive 180 cm antenna link found in Annex 1, which is link US-GSO D16. For the United States, this link provides primary DIRECTV service to large portions of Alaska.

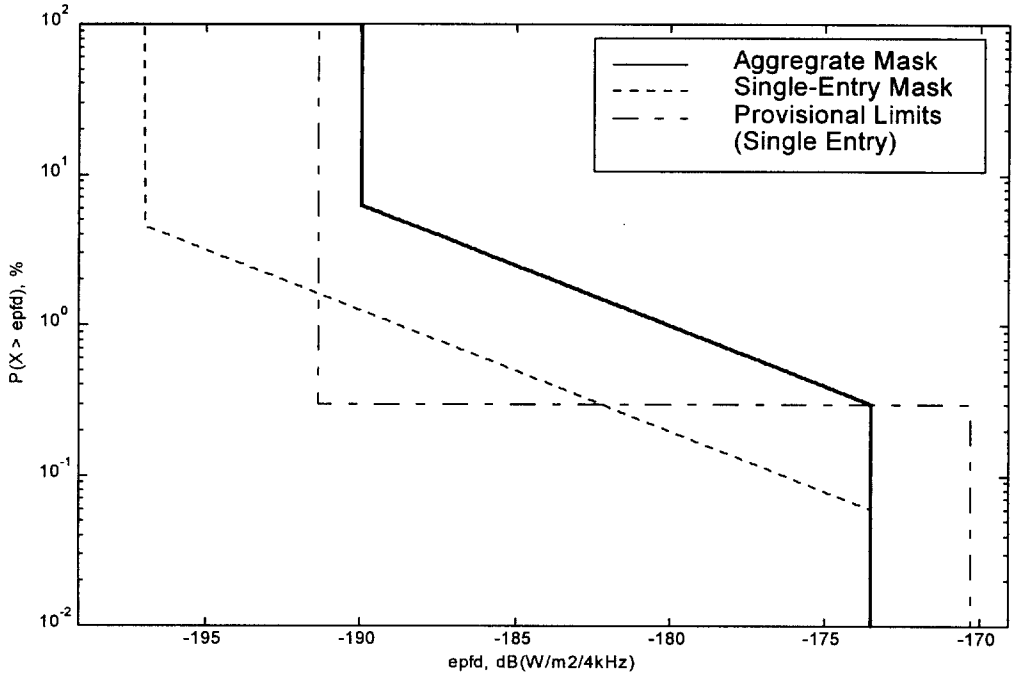

Figure 8.4-1: Proposed epfd Masks, 180 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask All NGSO Systems	
epfd dBW/m^2/4kHz	P (X<epfd), %
-190.0	93.75%
Slope = -12.5 dB/decade to –173.5	
–173.5	99.70%
–173.5	100%

Table 8.4-1: Proposed Aggregate Mask, 180 cm Antenna

Single Entry Mask	
epfd dBW/m^2/4kHz	P (X<epfd), %
-197	95.47%
Slope = -12.5 dB/decade to –173.5	
–173.5	99.94%
–173.5	100%

Table 8.4-2: Proposed Single Entry Mask, 180 cm Antenna

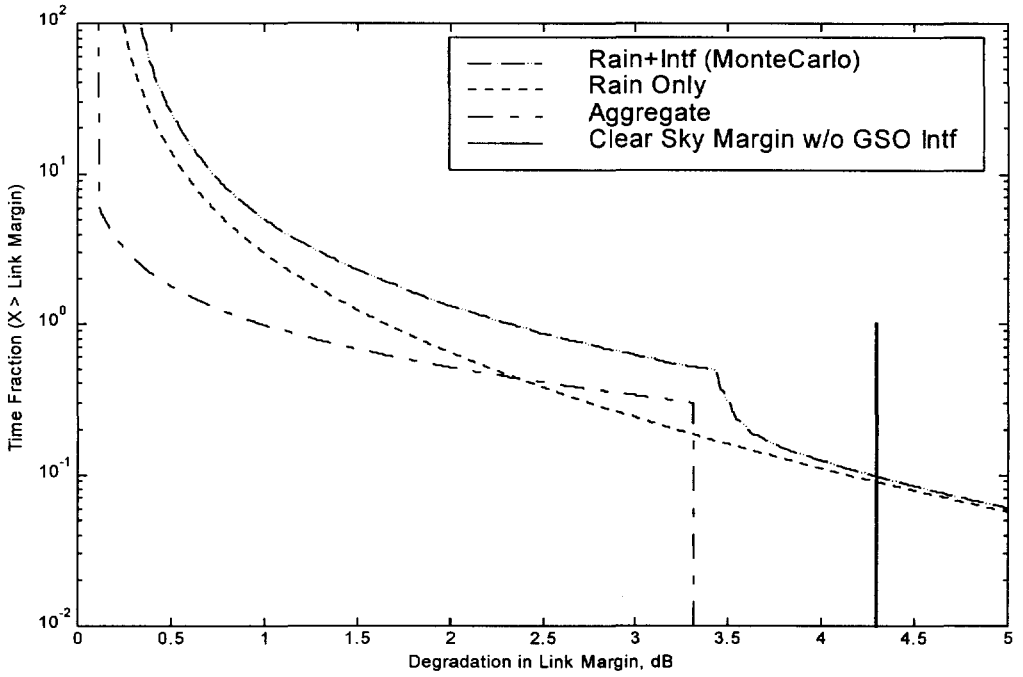

Figure 8.4-2: Evaluation of Aggregate NGSO Interference Mask on US-GSO D16 link

The vertical line at about 4.3 dB represents the amount of available degradation that can be suffered in the US-GSO D16 link before the signal falls below the required minimum C/(N+I) value. The change in unavailability at this point for the proposed aggregate mask is 9.5%, meeting the 10% criteria of the preliminary draft new recommendation.

Table 8.4-3 shows the result of the evaluation of the short-term epfd limit value in the proposed aggregate mask when applied to the US-GSO D16 BSS link against the 'no loss of synchronization' criterion.

1	NGSO epfd	dB(W/m2/4kHz)	-173.5
2			USA
3	**BSS Assignment characteristics**	**Units**	**US-GS0 D16**
4	**System Characteristics**		
5	Frequency	GHz	12.7
6	Availability objective	%	99.91
7	**Calculated availability due to rain up and downlink (Rec P 618-5)**	%	
8	**Calculated availability due to rain downlink (Rec P 618-5)**	%	
9	**Calculated availability due to rain uplink (Rec P 618-5)**	%	
10	Receiver noise Bandwidth	MHz	24
11	Modulation type		QPSK
12	C/I due to other GSO BSS networks	dB	23.7
13	***C/I due to NGSO FSS networks***	dB	10.8
14	*Clear sky feeder link C/N+I*	*dB*	*24.2*
15	C/N+I required at operating threshold	dB	3.5
16	Clear sky C/N+I margin above operating threshold (1)	dB	3.4
17	**Total Clear sky C/N+I margin above operating threshold (1)**	dB	
18	**Available clear sky downlink rain margin above threshold**	dB	
19	**Available clear sky uplink rain margin above threshold**	dB	
20	C/N+I total link for 99.7% of the time	dB	
21	C/N+I margin above operating threshold for 99.7% of the time	dB	1.7
22	C/N+I total link margin above operating threshold for 99.7% of the time	dB	
23	**Space station characteristics**		
24	Longitude	°	101W
25	Satellite e.i.r.p. in the direction of the earth station	dBW	37.8
26	**Earth station characteristics**		
27	Receive antenna diameter	cm	180
28	*Receive antenna efficiency*	*%*	*69*
29	On-axis antenna gain at receiver input	dBi	46
30	**On-axis antenna gain at antenna output**	**dBi**	
31	Off-axis antenna gain characteristics		App 30, An. 5
32	Clear sky receive system noise temperature at receiver input	K	125
33	Clear sky receive system noise temperature at antenna output	K	
34	*Clear sky G/T*	*dB/K*	*25*
35	Total pointing loss	dB	1.1
36	Location of earth station		
37	Latitude	°	57.0
38	Longitude	°	-134.5
39	Altitude	km	
40	Rain climatic zone		D
41	Elevation angle	°	17.8
42	**Propagation characteristics**		
43	*Slant path*	*km*	*38500*
44	*Free space loss*	*dB*	*206.2*
45	*Atmospheric absorption*	*dB*	*1.0*
46	Rain attenuation for 99.7% of the time	dB	1.0
47	*Noise increase due to rain for 99.7 % of the time*	*dB*	*1.7*
48	Wanted pfd received at earth station	dB(W/m2)	
49	Rain attenuation for availability percentage of time	dB	1.76
50	*Noise increase due to rain for availability percentage of time*	*dB*	*2.5*
51	**Downlink budget clear sky**		
52	*C/N thermal clear sky downlink*	*dB*	*9.3*
53	*C/N+I clear sky downlink*	*dB*	*6.9*
54	*C/N+I clear sky total link*	*dB*	*6.8*
55	Clear sky C/N downlink margin above operating threshold	dB	5.8
56	Clear sky C/N+I downlink margin above operating threshold	dB	3.4
57	Clear sky C/N+I total margin above operating threshold	dB	3.3

Table 8.4-3 'Loss of sync' calculation for link US-GSO D16

8.5 240 cm Antenna Aggregate and Single Entry EPFD Masks

Figure 8.4-1 illustrates the proposed masks to protect 240 cm BSS earth station antennas. An aggregate mask and a single entry mask are shown (no provisional limit is specified for

this antenna size). This mask protects the most sensitive 240 cm antenna link found in Annex 1, which is link US-GSO D18. For the United States, this link provides primary DIRECTV service to large portions of Alaska.

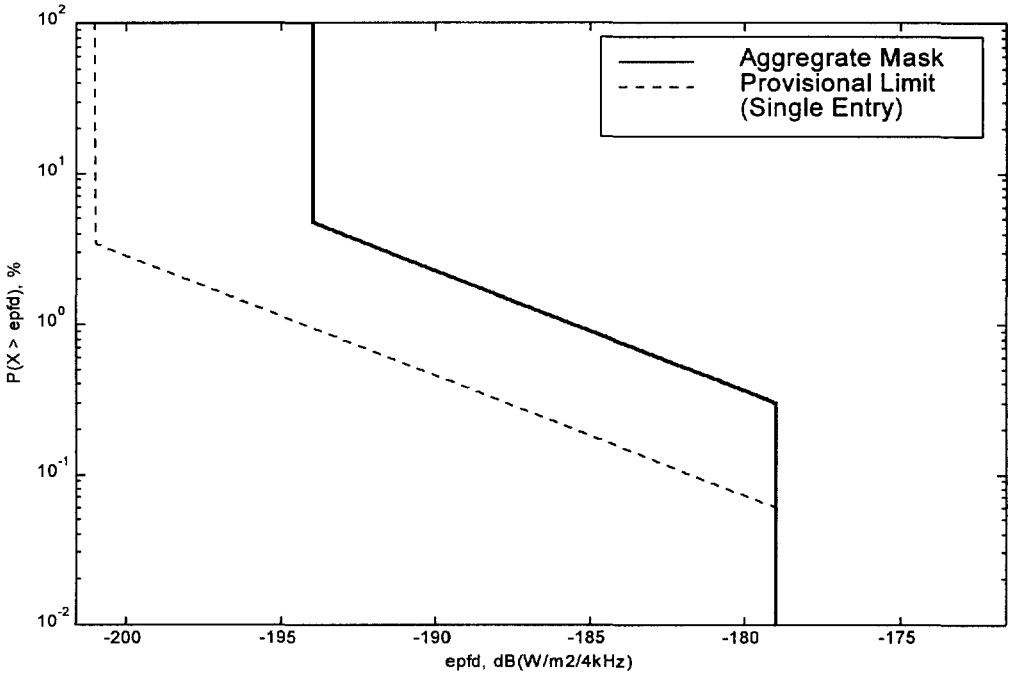

Figure 8.5-1: Proposed epfd Masks, 240 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask All NGSO Systems	
epfd dBW/m^2/4kHz	P (X<epfd), %
-194	95.26%
Slope = -12.5 dB/decade to -179.0	
-179	99.70%
-179	100%

Table 8.5-1: Proposed Aggregate Mask, 240 cm Antenna

Single Entry Mask	
Epfd DBW/m^2/4kHz	P (X<epfd), %
-201	96.56%
Slope = -12.5 dB/decade to -179.0	
-179	99.94%
-179	100%

Table 8.5-2: Proposed Single Entry Mask, 240 cm Antenna

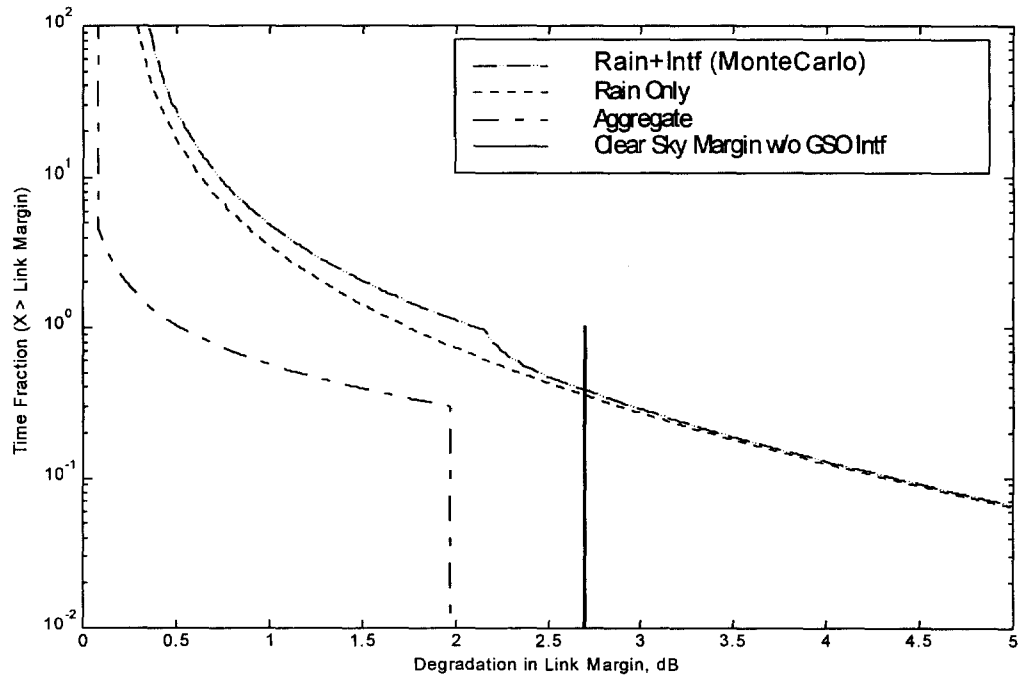

Figure 8.5-2: Evaluation of Aggregate NGSO Interference Mask on US-GSO D18 link

The vertical line at about 2.6 dB represents the amount of degradation that can be suffered in the US-GSO D18 link before the signal falls below the required minimum C/(N+I) value. The change in unavailability at this point for the proposed aggregate mask is 9.0%, meeting the 10% criteria of the preliminary draft new recommendation.

Table 8.5-3 shows the result of the evaluation of the short-term epfd limit value in the proposed aggregate mask when applied to the US-GSO D18 BSS link against the 'no loss of synchronization' criterion.

1	NGSO epfd	dB(W/m2/4kHz)	-179.0
2			USA
3	**BSS Assignment characteristics**	**Units**	**US-GS0 D18**
4	**System Characteristics**		
5	Frequency	GHz	12.7
6	Availability objective	%	99.66
7	**Calculated availability due to rain up and downlink (Rec P 618-5)**	%	
8	**Calculated availability due to rain downlink (Rec P 618-5)**	%	
9	**Calculated availability due to rain uplink (Rec P 618-5)**	%	
10	Receiver noise Bandwidth	MHz	24
11	Modulation type		QPSK
12	C/I due to other GSO BSS networks	dB	23.7
13	***C/I due to NGSO FSS networks***	dB	15.7
14	*Clear sky feeder link C/N+I*	*dB*	*24.2*
15	C/N+I required at operating threshold	dB	6.1
16	Clear sky C/N+I margin above operating threshold (1)	dB	3.0
17	**Total Clear sky C/N+I margin above operating threshold (1)**	dB	
18	**Available clear sky downlink rain margin above threshold**	dB	
19	**Available clear sky uplink rain margin above threshold**	dB	
20	C/N+I total link for 99.7% of the time	dB	
21	C/N+I margin above operating threshold for 99.7% of the time	dB	0.7
22	C/N+I total link margin above operating threshold for 99.7% of the time	dB	
23	**Space station characteristics**		
24	Longitude	°	101W
25	Satellite e.i.r.p. in the direction of the earth station	dBW	37.2
26	**Earth station characteristics**		
27	Receive antenna diameter	cm	240
28	*Receive antenna efficiency*	*%*	*69*
29	On-axis antenna gain at receiver input	dBi	48.5
30	**On-axis antenna gain at antenna output**	**dBi**	
31	Off-axis antenna gain characteristics		App 30, An. 5
32	Clear sky receive system noise temperature at receiver input	K	125
33	Clear sky receive system noise temperature at antenna output	K	
34	*Clear sky G/T*	*dB/K*	*28*
35	Total pointing loss	dB	2.0
36	Location of earth station		
37	Latitude	°	61.2
38	Longitude	°	-149.9
39	Altitude	km	
40	Rain climatic zone		C
41	Elevation angle	°	9.9
42	**Propagation characteristics**		
43	*Slant path*	*km*	*38500*
44	*Free space loss*	*dB*	*206.2*
45	*Atmospheric absorption*	*dB*	*1.0*
46	Rain attenuation for 99.7% of the time	dB	1.0
47	*Noise increase due to rain for 99.7 % of the time*	*dB*	*1.7*
48	Wanted pfd received at earth station	dB(W/m2)	
49	Rain attenuation for availability percentage of time	dB	0.96
50	*Noise increase due to rain for availability percentage of time*	*dB*	*1.6*
51	**Downlink budget clear sky**		
52	*C/N thermal clear sky downlink*	*dB*	*10.3*
53	*C/N+I clear sky downlink*	*dB*	*9.1*
54	*C/N+I clear sky total link*	*dB*	*8.9*
55	Clear sky C/N downlink margin above operating threshold	dB	4.2
56	Clear sky C/N+I downlink margin above operating threshold	dB	3.0
57	Clear sky C/N+I total margin above operating threshold	dB	2.8

Table 8.5-3 'Loss of sync' calculation for link US-GSO D18

8.6 90 cm Antenna Aggregate and Single Entry EPFD Masks; Region 2

In deriving epfd limits, it is important to treat limiting cases so that interference protection is afforded to the full potential range of BSS systems. A review of the Region 2 BSS links submitted to the SRG2 indicates that the 90 cm antenna links all have more than 5 dB of clear sky margin. It is very likely, however, that 90 cm antennas will reasonably be used in situations with lower clear sky margins than are represented in the SRG2 links.

In the continental United States, these antennas typically serve as head end antennas for multiple dwelling unit installations. This is also an important size of antenna for BSS service to Alaska.

Since the 90 cm antenna size is an important size in Region 2, an approach is needed to develop epfd limits that will protect both the SRG2 links and other future links that use this size of antenna. To meet this requirement, the long-term and short-term epfd limits for the 90 cm antenna size were determined by scaling the epfd limits proposed in this document from both larger and smaller antenna sizes. This technique provides consistency for the limits proposed for all the antenna sizes.

Figure 8.6-1 displays the scaling of the proposed long-term epfd limit with antenna size. From this graph, the scaled long-term epfd limit for 90 cm antennas is calculated to be -184.7dB(W/m2/4kHz). The mask derived using this limit will protect the 90 cm links submitted to the SRG2 to the levels described in the preliminary draft new recommendation. The long-term epfd limit cited above is for region C of Figure 7.2-1. The short-term limit is taken as -170 dB(W/m2/4kHz).

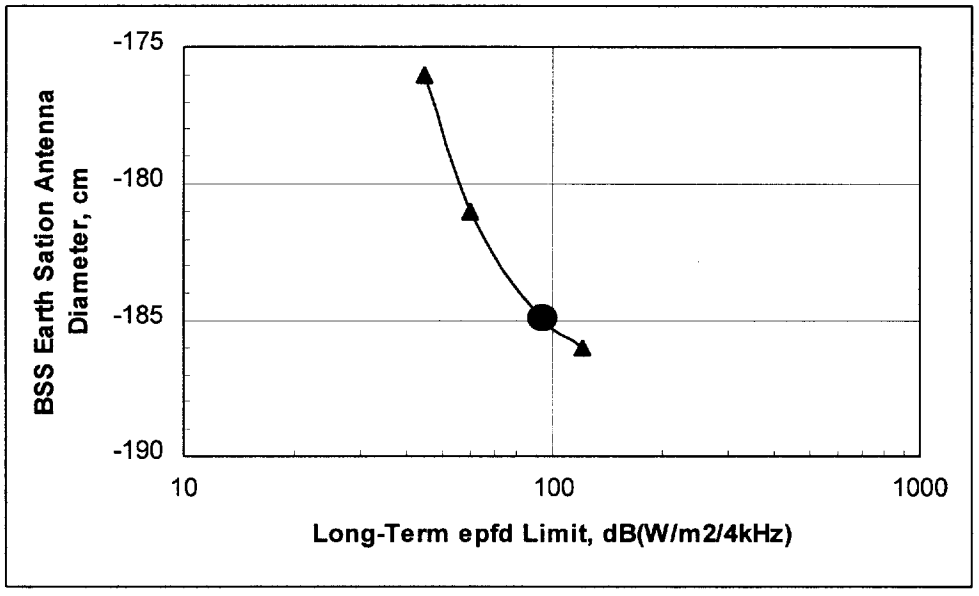

Figure 8.6-1: Scaling of long-term epfd limits with size of BSS earth station antenna.

There is great interest in the determination of a method to interpolate epfd interference limits across a range of antenna sizes. Figure 8.6-1, in combination with the mask template shown in Figure 7.2-1 provides the beginning of a method to arrive at such a result.

Figure 8.6-2 illustrates the resulting proposed masks to protect 90 cm BSS earth station antennas in Region 2. Two masks are shown. These include the aggregate mask for all NGSO systems sharing this band, and then the single entry mask.

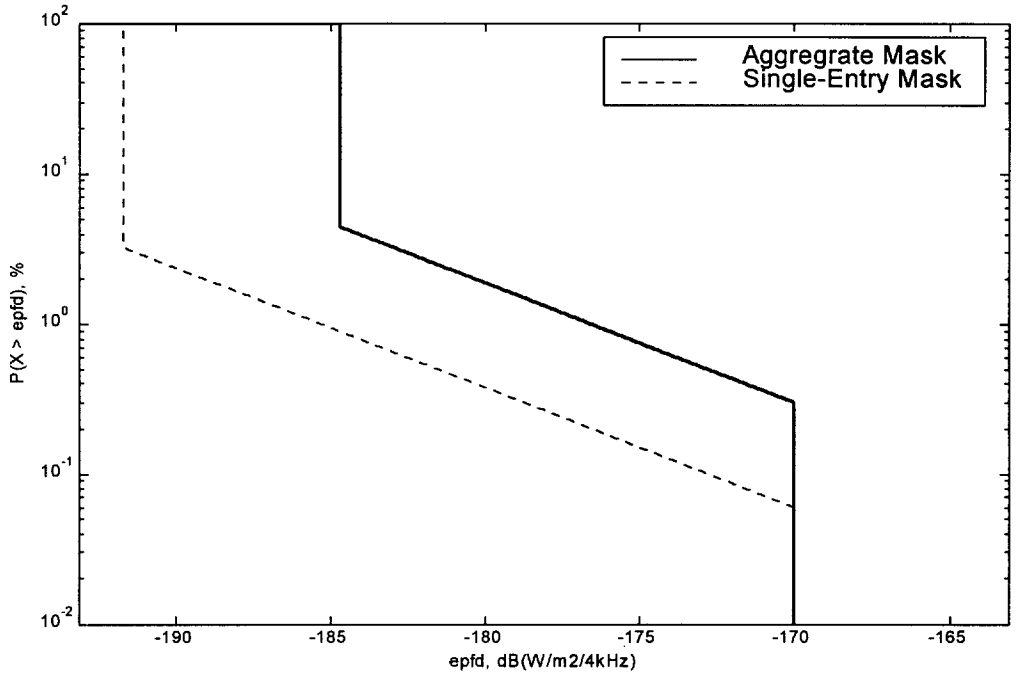

Figure 8.6-2: Proposed epfd Masks, 90 cm Antenna

The following tables describe the proposed masks in more detail:

Aggregate Mask All NGSO Systems	
epfd dBW/m^2/4kHz	P (X<epfd), %
-184.7	95.51%
Slope = -12.5 dB/decade to –170	
-170	99.70%
-170	100%

Table 8.6-1: Proposed Aggregate Mask, 90 cm Antenna

Single Entry Mask	
Epfd dBW/m^2/4kHz	P (X<epfd), %
-191.69	96.75%
Slope = -12.5 dB/decade to –170	
-170	99.94%
-170	100%

Table 8.6-3: Proposed Single Entry Mask, 90 cm Antenna

9 Protection of GSO BSS Systems at the Aggregate Limit

It is vital for the FCC to adopt rules that clearly protect GSO BSS and FSS systems from the accumulated effects of multiple NGSO systems. While there may be occasion for regulators to work with single entry limits, GSO operators must have reasonable assurance that aggregate limits will not be violated in the long term.

Fundamental to the protection of any GSO system is collective compliance by all NGSO systems with an aggregate interference limit. A central reason for developing such an aggregate limit is the uncertainty surrounding the number of NGSO systems and satellites that could ultimately share the NGSO space and spectrum resource.

Because DIRECTV believes that conservative estimations must be made at this time on the value for the maximum number "n" of NGSO systems that can be expected to share the

same band, Section 8 uses the value 5 for "n." However, work to provide a definitive value for that value has been inconclusive at best, and serious issues surrounding the implementation of an aggregate limit will still need to be addressed regardless of how that number is defined.

First, given the uncertainty surrounding the ultimate number of NGSO systems, it is not difficult to foresee a scenario where, even if each NGSO system individually meets a single entry interference limit, aggregate interference levels required for the protection of GSO BSS by NGSO FSS could still be exceeded, especially if technological advances allow for a higher "n" than currently predicted. Thus, GSO operators also need the regulatory assurance that a first-come, first-served rule for licensing NGSO systems will not backfire in the event that follow-on NGSO systems, asking for as much of the NGSO space, spectrum and interference limit resource as their predecessors, do not cause the aggregate interference limit to be exceeded. Whatever the value for "n" proves to be, it must be clear that the aggregate protection limit will not be expanded, and that the burden will be upon NGSO operators to share the spectrum and interference limit resource.

Second, there are different classes of NGSO systems that may contribute to the interference environment in ways that are not yet fully understood. For example, a quasi-GSO system has very different operational characteristics, and interference does not add in the same way, as a LEO system. This type of co-existence again must be managed in a manner that does not exceed the aggregate limit.

Third, there are potential issues involving the definition of an NGSO system that may permit one NGSO system operator to gain a larger interference allocation than is fair. The Commission will have to address how to fairly apportion the aggregate interference allowed among "n" systems and ensure that the aggregate limit is not exceeded.

These issues are examples of those that will need to be seriously addressed by the FCC in developing service rules and licensing procedures regarding NGSO systems.

10 Impact of Proposed Limits on NGSO Systems

One of the technical challenges facing NGSO FSS systems in terms of meeting epfd interference limits is the ability of the NGSO system design to meet a short-term interference limit. The short-term limit becomes more important (and typically more stringent) as the victim earth station antenna size increases. The short-term epfd limits proposed in this document become increasingly more severe as the antenna size of the BSS earth station increases. This increasing severity is necessary to protect these antennas per the requirements of the 10-11S PDNR.

It is important to note that certain NGSO system design parameters can be directly related to the short-term interference performance of the system. For LEO NGSO systems, an important parameter is the amount of roll-off of the NGSO transmitting antenna, especially at points near 10° from the peak of the beam. An improvement in sidelobe performance of several dB can dramatically improve the short-term interference characteristics of an NGSO system. Significantly, WRC-97 deferred the adoption of final epfd limits until after technical studies were completed, and ordered that all NGSO systems comply with the

final technical standards. It is critical that this policy be strictly adhered to. NGSO system designers must understand that they are 'building at risk' and may need to redesign certain system elements to fully protect GSO BSS and FSS systems.

11 Reference BSS Earth Station Antenna Patterns

The antenna gain characteristics of BSS earth station antennas in directions away from the geostationary arc are of particular importance in analyzing interference from NGSO FSS systems. This issue has garnered considerable attention since it was raised by Canada at the July JTG 4-9-11 meeting. In document JTG4-9-11/172, Canada reported that the sidelobes measured for small BSS earth station antennas were asymmetric and, in some directions, were significantly higher than the sidelobes specified in reference antenna patterns in the ITU Radio Regulations (*e.g.*, Figure 8 of Annex 5 to Appendix 30). Additional work reported by Canada at the January 1999 JTG 4-9-11 meeting in document JTG 4-9-11/356 confirmed these findings (*see* plate 2 on page 7 of this document which show a peak sidelobe level of about 3 dBi for a 45-cm antenna).

On-going work in the international community is addressing this issue. At its October 1998 meeting, JWP 10-11S developed a preliminary draft new recommendation with a three-dimensional pattern for 45 cm antennas. This work plus new measurements were used by JTG 4-9-11 in document 4-9-11/TEMP/82 titled "Reference BSS earth station antenna patterns for the calculation of interference from NGSO FSS satellites in the 12 GHz bands." This document provides guidelines for the earth station antenna patterns to be used to calculate interference from NGSOs into victim earth stations. For earth station antennas with a diameter of 60 cm or less, provisions are made in this document to use three-dimensional antenna patterns that may include asymmetric sidelobe features. This document was forwarded to 10-11S for its consideration.

It is expected that JWP 10-11S will further refine the PDNR to reflect recent measurements and a new Recommendation will ultimately be adopted to address this issue. However, until this antenna analysis is completed and suitable masks are agreed upon, utmost care must be exercised to ensure that small BSS earth station antennas are adequately protected from NGSO interference. Any new antenna mask adopted for use in the epfd calculation software should take the following factors into account. These factors will help ensure that BSS antennas are adequately protected:

1. The antenna pattern mask must take into account the full three dimensional gain characteristics of the antenna. Offset fed reflectors, commonly used for the BSS, have a distinct asymmetric pattern in the elevation plane. This pattern becomes significant when calculating interference from sources that are away from the geostationary arc, such as those from NGSO FSS satellites.

2. The antenna mask must take into account the fact that the sidelobe gain patterns of field-deployed BSS antennas sidelobe specifications that are generally given only in the plane of vary across the population. These antennas are typically built to meet the geostationary orbit. Not only can the specifications vary from BSS operator to operator, but for any given operator's specification there can be manufacturer model to manufacturer model pattern variations, as well as pattern variations from serial number to serial number within a given model.

Annex 1: BSS Links to be Protected

		USA	USA	USA	USA	USA	USA	USA	USA	USA	USA
BSS Assignment characteristics	**Units**	**US-GSO 1(a)**	**US-GSO 1(b)**	**US-GSO 2(a)**	**US-GSO 2(b)**	**US-GSO D1(a)**	**US-GSO D1(b)**	**US-GSO D2(a)**	**US-GSO D2(b)**	**US-GSO D3(a)**	**US-GSO D3(b)**
System Characteristics											
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700
Availability objective	%	99.92	99.94	99.99	99.99	99.80	99.83	99.91	99.92	99.80	99.84
Calculated availability due to rain up and downlink (Rec P 618-5)	%										
Calculated availability due to rain downlink (Rec P 618-5)	%										
Calculated availability due to rain uplink (Rec P 618-5)	%										
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	20.7	23.7	20.7	23.7	20.7	23.7	20.7	23.7	20.7	23.7
C/I due to GSO FSS networks	dB	99	99	99	99	99	99	99	99	99	99
Clear sky feeder link C/N+I	*dB*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*
C/N+I required at operating threshold	dB	5.0	7.6	5.1	7.6	5.0	7.6	5.0	7.6	5.0	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	3.6	4.0	8.8	9.3	8.8	9.2	6.7	7.1	4.6	5.0
Total Clear sky C/N+I margin above operating threshold (1)	dB										
Available clear sky downlink rain margin above threshold	dB										
Available clear sky uplink rain margin above threshold	dB										
C/N+I total link for 99.7% of the time	dB										
C/N+I margin above operating threshold for 99.7% of the time	dB	1.5	1.9	6.9	7.4	1.2	1.6	2.4	2.8	0.7	1.1
C/N+I total link margin above operating threshold for 99.7% of the time	dB										
Space station characteristics											
Longitude	°	101W	101W	101W	101W	101W	101W	101W	101W	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	48	51	48	51	53.9	56.9	51.4	54.4	49.1	52.1
Earth station characteristics											
Receive antenna diameter	cm	45	45	90	90	45	45	45	45	45	45
Receive antenna efficiency	*%*	*70*	*70*	*70*	*70*	*70*	*70*	*70*	*70*	*70*	*70*
On-axis antenna gain at receiver input	dBi	34	34	40	40	34	34	34	34	34	34
On-axis antenna gain at antenna output	**dBi**										
Off-axis antenna gain characteristics		App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5	App 30, An. 5
Clear sky receive system noise temperature at receiver input	K	125	125	125	125	125	125	125	125	125	125
Clear sky receive system noise temperature at antenna output	K										
Clear sky G/T	*dB/K*	*13*	*13*	*19*	*19*	*13*	*13*	*13*	*13*	*13*	*13*
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Location of earth station											
Latitude	°	47.6	47.6	47.6	47.6	27.9	27.9	40.7	40.7	45.0	45.0
Longitude	°	122.3W	122.3W	122.3W	122.3W	82.5W	82.5W	74W	74W	93.3W	93.3W
Altitude	km										
Rain climatic zone		D	D	D	D	N	N	K	K	K	K
Elevation angle	°	31.5	31.5	31.5	31.5	51.5	51.5	35.4	35.4	37.6	37.6
Propagation characteristics											
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*
Atmospheric absorption	*dB*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Rain attenuation for 99.7% of the time	dB	0.80	0.80	0.80	0.80	4.45	4.45	2.03	2.03	1.74	1.74
Noise increase due to rain for 99.7 % of the time	*dB*	*1.4*	*1.4*	*1.4*	*1.4*	*4.0*	*4.0*	*2.7*	*2.7*	*2.5*	*2.5*
Wanted pfd received at earth station	dB(W/m2)										
Rain attenuation for availability percentage of time	dB	1.50	1.75	5.40	5.85	5.45	5.80	3.55	3.85	2.10	2.35
Noise increase due to rain for availability percentage of time	*dB*	*2.2*	*2.5*	*4.2*	*4.3*	*4.2*	*4.3*	*3.6*	*3.7*	*2.8*	*2.9*

		USA	USA	USA	USA	USA	USA	USA	USA	USA	USA
BSS Assignment characteristics	**Units**	**US-GSO 1(a)**	**US-GSO 1(b)**	**US-GSO 2(a)**	**US-GSO 2(b)**	**US-GSO D1(a)**	**US-GSO D1(b)**	**US-GSO D2(a)**	**US-GSO D2(b)**	**US-GSO D3(a)**	**US-GSO D3(b)**
Downlink budget clear sky											
C/N thermal clear sky downlink	*dB*	*8.9*	*11.9*	*14.9*	*17.9*	*14.8*	*17.8*	*12.3*	*15.3*	*10.0*	*13.0*
C/N+I clear sky downlink	*dB*	*8.6*	*11.6*	*13.9*	*16.9*	*13.8*	*16.8*	*11.7*	*14.7*	*9.6*	*12.6*
C/N+I clear sky total link	*dB*	*8.5*	*11.4*	*13.5*	*16.1*	*13.4*	*16.1*	*11.5*	*14.3*	*9.5*	*12.4*
Clear sky C/N downlink margin above operating threshold	dB	3.9	4.3	9.8	10.3	9.8	10.2	7.3	7.7	5.0	5.4
Clear sky C/N+I downlink margin above operating threshold	dB	3.6	4.0	8.8	9.3	8.8	9.2	6.7	7.1	4.6	5.0
Clear sky C/N+I total margin above operating threshold	dB	3.5	3.8	8.4	8.5	8.4	8.5	6.5	6.7	4.5	4.8
Downlink budget 99.7% of the time											
C/N thermal for 99.7% of the time, downlink	*dB*	*6.7*	*9.7*	*12.7*	*15.7*	*6.4*	*9.4*	*7.6*	*10.6*	*5.8*	*8.8*
C/N+I for 99.7% of the time, downlink	*dB*	*6.5*	*9.5*	*12.0*	*15.0*	*6.2*	*9.2*	*7.4*	*10.4*	*5.7*	*8.7*
C/N margin above operating threshold for 99.7% of the time, downlink	dB	1.7	2.1	7.6	8.1	1.4	1.8	2.6	3.0	0.8	1.2
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	1.5	1.9	6.9	7.4	1.2	1.6	2.4	2.8	0.7	1.1
Downlink budget for availability percentage of time											
C/N thermal for availability percentage of time, downlink	*dB*	*5.2*	*7.7*	*5.3*	*7.7*	*5.1*	*7.7*	*5.1*	*7.7*	*5.1*	*7.7*
C/N+I for availability percentage of time, downlink	*dB*	*5.0*	*7.6*	*5.1*	*7.6*	*5.0*	*7.6*	*5.0*	*7.6*	*5.0*	*7.6*
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control											
Minimum feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Longitude	°	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
Altitude	km										
Rain climatic zone		E	E	E	E	E	E	E	E	E	E
Elevation angle	°	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Rain attenuation for availability percentage of time	dB										
Characteristics of the space station receiver											
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control setting											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB										
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Uplink budget											
Atmospheric absorption	*dB*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*
C/N thermal clear sky	*dB*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*
C/N+I clear sky	dB	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
C/N thermal uplink for 99.97% of the time	dB										
C/N+I uplink for 99.97% of the time	dB										
Available clear sky uplink rain margin above threshold	dB										

Footnote 1: For US-GSO D5, rain effects are not relevant.
Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165
Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

		USA	USA	USA	USA	USA	USA	USA	USA	USA
BSS Assignment characteristics	**Units**	**US-GSO D4**	**US-GSO D5(a)**	**US-GSO D5(b)**	**US-GSO D6(a)**	**US-GSO D6(b)**	**US-GSO D7(a)**	**US-GSO D7(b)**	**US-GSO D8(a)**	**US-GSO D8(b)**
System Characteristics										
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.700
Availability objective	%	99.90	Footnote 1	Footnote 1	99.96	99.97	99.92	99.94	99.80	99.83
Calculated availability due to rain up and downlink (Rec P 618-5)	%									
Calculated availability due to rain downlink (Rec P 618-5)	%									
Calculated availability due to rain uplink (Rec P 618-5)	%									
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24
Modulation type		8PSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	20	20.7	23.7	20.7	23.7	20.7	23.7	20.7	23.7
C/I due to GSO FSS networks	dB	99	99	99	99	99	99	99	99	99
Clear sky feeder link C/N+I	*dB*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*
C/N+I required at operating threshold	dB	11	5.0	7.6	5.0	7.6	5	7.6	5.0	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	2.8	0.5	0.9	5.4	5.8	3.6	4.0	8.8	9.2
Total Clear sky C/N+I margin above operating threshold (1)	dB									
Available clear sky downlink rain margin above threshold	dB									
Available clear sky uplink rain margin above threshold	dB									
C/N+I total link for 99.7% of the time	dB									
C/N+I margin above operating threshold for 99.7% of the time	dB	1.0	0.5	0.9	2.7	3.1	1.5	1.9	1.2	1.6
C/N+I total link margin above operating threshold for 99.7% of the time	dB									
Space station characteristics										
Longitude	°	101W	101W	101W	101W	101W	101W	101W	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	54.1	48	51	48	51	48	51	53.9	56.9
Earth station characteristics										
Receive antenna diameter	cm	45	measured	measured	45	45	45	45	45	45
Receive antenna efficiency	*%*	*~0*			*~0*	*~0*	*~0*	*~0*	*~0*	*~0*
On-axis antenna gain at receiver input	dBi	34	30	30	34	34	34	34	34	34
On-axis antenna gain at antenna output	**dBi**									
Off-axis antenna gain characteristics		App 30, An. 5	Footnote 2	Footnote 2	App 30, An. 5	App 30, An. 5	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K	125	110	110	80	80	125	125	125	125
Clear sky receive system noise temperature at antenna output	K									
Clear sky G/T	*dB/K*	*13*	*10*	*10*	*15*	*15*	*13*	*13*	*13*	*13*
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Location of earth station										
Latitude	°	47.6	47.6	47.6	47.6	47.6	47.6	47.6	27.9	27.9
Longitude	°	122.3W	122.3W	122.3W	122.3W	122.3W	122.3W	122.3W	82.5W	82.5W
Altitude	km									
Rain climatic zone		D	D	D	D	D	D	D	N	N
Elevation angle	°	31.5	Variable	Variable	31.5	31.5	31.5	31.5	51.5	51.5
Propagation characteristics										
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*
Atmospheric absorption	*dB*	*0.2*	*0*	*0*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Rain attenuation for 99.7% of the time	dB	0.80	0	0	0.80	0.80	0.80	0.80	4.45	4.45
Noise increase due to rain for 99.7 % of the time	*dB*	*1.4*	*0*	*0*	*2.1*	*2.1*	*1.4*	*1.4*	*4.0*	*4.0*
Wanted pfd received at earth station	dB(W/m2)									
Rain attenuation for availability percentage of time	dB	1.32	0	0	2.00	2.25	1.50	1.75	5.45	5.80
Noise increase due to rain for availability percentage of time	*DB*	*2.1*	*0.0*	*0.0*	*3.7*	*3.9*	*2.2*	*2.5*	*4.2*	*4.3*

		USA	USA	USA	USA	USA	USA	USA	USA	USA
BSS Assignment characteristics	**Units**	**US-GSO D4**	**US-GSO D5(a)**	**US-GSO D5(b)**	**US-GSO D6(a)**	**US-GSO D6(b)**	**US-GSO D7(a)**	**US-GSO D7(b)**	**US-GSO D8(a)**	**US-GSO D8(b)**
Downlink budget clear sky										
C/N thermal clear sky downlink	*dB*	*15.0*	*5.7*	*8.7*	*10.8*	*13.8*	*8.9*	*11.9*	*14.8*	*17.8*
C/N+I clear sky downlink	*dB*	*13.8*	*5.5*	*8.5*	*10.4*	*13.4*	*8.6*	*11.6*	*13.8*	*16.8*
C/N+I clear sky total link	*dB*	*13.4*	*5.5*	*8.4*	*10.2*	*13.1*	*8.5*	*11.4*	*13.4*	*16.1*
Clear sky C/N downlink margin above operating threshold	dB	4.0	0.7	1.1	5.8	6.2	3.9	4.3	9.8	10.2
Clear sky C/N+I downlink margin above operating threshold	dB	2.8	0.5	0.9	5.4	5.8	3.6	4.0	8.8	9.2
Clear sky C/N+I total margin above operating threshold	dB	2.4	0.5	0.8	5.2	5.5	3.5	3.8	8.4	8.5
Downlink budget 99.7% of the time										
C/N thermal for 99.7% of the time, downlink	*dB*	*12.8*	*5.7*	*8.7*	*8.0*	*11.0*	*6.7*	*9.7*	*6.4*	*9.4*
C/N+I for 99.7% of the time, downlink	*dB*	*12.0*	*5.5*	*8.5*	*7.7*	*10.7*	*6.5*	*9.5*	*6.2*	*9.2*
C/N margin above operating threshold for 99.7% of the time, downlink	dB	1.8	0.7	1.1	3.0	3.4	1.7	2.1	1.4	1.8
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	1.0	0.5	0.9	2.7	3.1	1.5	1.9	1.2	1.6
Downlink budget for availability percentage of time										
C/N thermal for availability percentage of time, downlink	*dB*	*11.6*	*5.7*	*8.7*	*5.2*	*7.7*	*5.2*	*7.7*	*5.1*	*7.7*
C/N+I for availability percentage of time, downlink	*dB*	*11.0*	*5.5*	*8.5*	*5.0*	*7.6*	*5.0*	*7.6*	*5.0*	*7.6*
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.6	0.7	1.1	0.2	0.1	0.2	0.1	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.03	0.52	0.92	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics										
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control										
Minimum feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Longitude	°	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
Altitude	km									
Rain climatic zone		E	E	E	E	E	E	E	E	E
Elevation angle	°	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Rain attenuation for availability percentage of time	dB									
Characteristics of the space station receiver										
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control setting										
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB									
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Uplink budget										
Atmospheric absorption	*dB*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*
C/N thermal clear sky	*dB*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*
C/N+I clear sky	dB	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
C/N thermal uplink for 99.97% of the time	dB									
C/N+I uplink for 99.97% of the time	dB									
Available clear sky uplink rain margin above threshold	dB									

Footnote 1: For US-GSO D5, rain effects are not relevant.
Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165
Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

BSS Assignment characteristics	Units	USA US-GSO D9(a)	USA US-GSO D9(b)	USA US-GSO D10(a)	USA US-GSO D10(b)	USA US-GSO D11	USA US-GSO D12(a)	USA US-GSO D12(b)	USA US-GS0 D15	USA US-GS0 D16	USA US-GS0 D17
System Characteristics											
Frequency	GHz	12.700	12.700	12.700	12.700	12.700	12.700	12.700	12.7	12.7	12.7
Availability objective	%	99.91	99.92	99.80	99.84	99.90	99.96	99.97	99.90	99.91	99.84
Calculated availability due to rain up and downlink (Rec P 618-	%										
Calculated availability due to rain downlink (Rec P 618-5)	%										
Calculated availability due to rain uplink (Rec P 618-5)	%										
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	8PSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	20.7	23.7	20.7	23.7	20	20.7	23.7	23.7	23.7	23.7
C/I due to GSO FSS networks	dB	99	99	99	99	99	99	99	99	99	99
Clear sky feeder link C/N+I	*dB*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*	*24.2*
C/N+I required at operating threshold	dB	5.0	7.6	5.0	7.6	11	5.0	7.6	7.6	5.0	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	6.7	7.1	4.6	5.0	2.8	5.4	5.8	3.8	4.1	3.4
Total Clear sky C/N+I margin above operating threshold (1)	dB										
Available clear sky downlink rain margin above threshold	dB										
Available clear sky uplink rain margin above threshold	dB										
C/N+I total link for 99.7% of the time	dB										
C/N+I margin above operating threshold for 99.7% of the time	dB	2.4	2.8	0.7	1.1	1.0	2.7	3.1	1.3	1.6	0.7
C/N+I total link margin above operating threshold for 99.7% of the	dB										
Space station characteristics											
Longitude	°	101W	101W	101W	101W	101W	101W	101W	101W	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	51.4	54.4	49.1	52.1	54.1	48	51	43.1	37.8	38.1
Earth station characteristics											
Receive antenna diameter	cm	45	45	45	45	45	45	45	120	180	240
Receive antenna efficiency	*%*	*70*	*70*	*70*	*70*	*70*	*70*	*70*	*70*	*69*	*69*
On-axis antenna gain at receiver input	dBi	34	34	34	34	34	34	34	42.5	46	48.5
On-axis antenna gain at antenna output	**dBi**										
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	App 30, An. 5	App 30, An. 5	App 30, An. 5
Clear sky receive system noise temperature at receiver input	K	125	125	125	125	125	80	80	125	125	125
Clear sky receive system noise temperature at antenna output	K										
Clear sky G/T	*dB/K*	*13*	*13*	*13*	*13*	*13*	*15*	*15*	*22*	*25*	*28*
Total pointing loss	dB	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.1	2.0
Location of earth station											
Latitude	°	40.7	40.7	45.0	45.0	47.6	47.6	47.6	57.0	57.0	61.2
Longitude	°	74W	74W	93.3W	93.3W	122.3W	122.3W	122.3W	-134.5	-134.5	-149.9
Altitude	km										
Rain climatic zone		K	K	K	K	D	D	D	D	D	C
Elevation angle	°	35.4	35.4	37.6	37.6	31.5	31.5	31.5	17.8	17.8	9.9
Propagation characteristics											
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*	*206.2*
Atmospheric absorption	*dB*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*1.0*	*1.0*	*1.0*
Rain attenuation for 99.7% of the time	dB	2.03	2.03	1.74	1.74	0.80	0.80	0.80	1.0	1.0	1.0
Noise increase due to rain for 99.7 % of the time	*dB*	*2.7*	*2.7*	*2.5*	*2.5*	*1.4*	*2.1*	*2.1*	*1.7*	*1.7*	*1.7*
Wanted pfd received at earth station	dB(W/m2)										
Rain attenuation for availability percentage of time	dB	3.55	3.85	2.10	2.35	1.32	2.00	2.25	1.63	1.76	1.37
Noise increase due to rain for availability percentage of time	*dB*	*3.6*	*3.7*	*2.8*	*2.9*	*2.1*	*3.7*	*3.9*	*2.4*	*2.5*	*2.1*

		USA	USA	USA	USA	USA	USA	USA	USA	USA	USA
BSS Assignment characteristics	**Units**	**US-GSO D9(a)**	**US-GSO D9(b)**	**US-GSO D10(a)**	**US-GSO D10(b)**	**US-GSO D11**	**US-GSO D12(a)**	**US-GSO D12(b)**	**US-GS0 D15**	**US-GS0 D16**	**US-GS0 D17**
Downlink budget clear sky											
C/N thermal clear sky downlink	*dB*	*12.3*	*15.3*	*10.0*	*13.0*	*15.0*	*10.8*	*13.8*	*11.7*	*9.3*	*11.2*
C/N+I clear sky downlink	*dB*	*11.7*	*14.7*	*9.6*	*12.6*	*13.8*	*10.4*	*13.4*	*11.4*	*9.1*	*11.0*
C/N+I clear sky total link	*dB*	*11.5*	*14.3*	*9.5*	*12.4*	*13.4*	*10.2*	*13.1*	*11.2*	*9.0*	*10.8*
Clear sky C/N downlink margin above operating threshold	dB	7.3	7.7	5.0	5.4	4.0	5.8	6.2	4.1	4.3	3.6
Clear sky C/N+I downlink margin above operating threshold	dB	6.7	7.1	4.6	5.0	2.8	5.4	5.8	3.8	4.1	3.4
Clear sky C/N+I total margin above operating threshold	dB	6.5	6.7	4.5	4.8	2.4	5.2	5.5	3.6	4.0	3.2
Downlink budget 99.7% of the time											
C/N thermal for 99.7% of the time, downlink	*dB*	*7.6*	*10.6*	*5.8*	*8.8*	*12.8*	*8.0*	*11.0*	*9.1*	*6.7*	*8.5*
C/N+I for 99.7% of the time, downlink	*dB*	*7.4*	*10.4*	*5.7*	*8.7*	*12.0*	*7.7*	*10.7*	*8.9*	*6.6*	*8.3*
C/N margin above operating threshold for 99.7% of the time, downlink	dB	2.6	3.0	0.8	1.2	1.8	3.0	3.4	1.5	1.7	0.9
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	2.4	2.8	0.7	1.1	1.0	2.7	3.1	1.3	1.6	0.7
Downlink budget for availability percentage of time											
C/N thermal for availability percentage of time, downlink	*dB*	*5.1*	*7.7*	*5.1*	*7.7*	*11.6*	*5.2*	*7.7*	*7.7*	*5.1*	*7.7*
C/N+I for availability percentage of time, downlink	*dB*	*5.0*	*7.6*	*5.0*	*7.6*	*11.0*	*5.0*	*7.6*	*7.6*	*5.0*	*7.6*
C/N margin above operating threshold for availability percentage of the time,	dB	0.1	0.1	0.1	0.1	0.6	0.2	0.1	0.1	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.03	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control											
Minimum feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
Longitude	°	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
Altitude	km										
Rain climatic zone		E	E	E	E	E	E	E	E	E	E
Elevation angle	°	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Rain attenuation for availability percentage of time	dB										
Characteristics of the space station receiver											
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control setting											
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I from other assignments in the Plan	dB										
C/I from other GSO FSS systems	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Uplink budget											
Atmospheric absorption	*dB*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Slant path	*km*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*	*38500*
Free space loss	*dB*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*	*209.1*
C/N thermal clear sky	*dB*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*	*27.5*
C/N+I clear sky	dB	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
C/N thermal uplink for 99.97% of the time	dB										
C/N+I uplink for 99.97% of the time	dB										
Available clear sky uplink rain margin above threshold	dB										

Footnote 1: For US-GSO D5, rain effects are not relevant.
Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-
Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-

BSS Assignment characteristics	Units	USA US-GS0 D18	USA US-GS0 D19
System Characteristics			
Frequency	GHz	12.7	12.7
Availability objective	%	99.66	99.95
Calculated availability due to rain up and downlink (Rec P 618-5)	%		
Calculated availability due to rain downlink (Rec P 618-5)	%		
Calculated availability due to rain uplink (Rec P 618-5)	%		
Receiver noise Bandwidth	MHz	24	24
Modulation type		QPSK	QPSK
C/I due to other GSO BSS networks	dB	23.7	23.7
C/I due to GSO FSS networks	dB	99	99
Clear sky feeder link C/N+I	*dB*	*24.2*	*24.2*
C/N+I required at operating threshold	dB	7.6	7.6
Clear sky C/N+I margin above operating threshold (1)	dB	2.5	6.3
Total Clear sky C/N+I margin above operating threshold (1)	dB		
Available clear sky downlink rain margin above threshold	dB		
Available clear sky uplink rain margin above threshold	dB		
C/N+I total link for 99.7% of the time	dB		
C/N+I margin above operating threshold for 99.7% of the time	dB	-0.2	3.0
C/N+I total link margin above operating threshold for 99.7% of the time	dB		
Space station characteristics			
Longitude	°	101W	101W
Satellite e.i.r.p. in the direction of the earth station	dBW	37.2	45
Earth station characteristics			
Receive antenna diameter	cm	240	120
Receive antenna efficiency	*%*	*69*	*70*
On-axis antenna gain at receiver input	dBi	48.5	42.5
On-axis antenna gain at antenna output	**dBi**		
Off-axis antenna gain characteristics		App 30, An. 5	App 30, An. 5
Clear sky receive system noise temperature at receiver input	K	125	125
Clear sky receive system noise temperature at antenna output	K		
Clear sky G/T	*dB/K*	*28*	*22*
Total pointing loss	dB	2.0	0.5
Location of earth station			
Latitude	°	61.2	21.3
Longitude	°	-149.9	-157.8
Altitude	km		
Rain climatic zone		C	D
Elevation angle	°	9.9	22.6
Propagation characteristics			
Slant path	*km*	*38500*	*38500*
Free space loss	*dB*	*206.2*	*206.2*
Atmospheric absorption	*dB*	*1.0*	*0.2*
Rain attenuation for 99.7% of the time	dB	1.0	1.4
Noise increase due to rain for 99.7 % of the time	*dB*	*1.7*	*2.2*
Wanted pfd received at earth station	dB(W/m2)		
Rain attenuation for availability percentage of time	dB	0.96	3.23
Noise increase due to rain for availability percentage of time	*dB*	*1.6*	*3.5*

BSS Assignment characteristics	Units	USA US-GS0 D18	USA US-GS0 D19
Downlink budget clear sky			
C/N thermal clear sky downlink	*dB*	*10.3*	*14.4*
C/N+I clear sky downlink	*dB*	*10.1*	*13.9*
C/N+I clear sky total link	*dB*	*9.9*	*13.5*
Clear sky C/N downlink margin above operating threshold	dB	2.7	6.8
Clear sky C/N+I downlink margin above operating threshold	dB	2.5	6.3
Clear sky C/N+I total margin above operating threshold	dB	2.3	5.9
Downlink budget 99.7% of the time			
C/N thermal for 99.7% of the time, downlink	*dB*	*7.6*	*10.8*
C/N+I for 99.7% of the time, downlink	*dB*	*7.4*	*10.6*
C/N margin above operating threshold for 99.7% of the time, downlink	dB	0.0	3.2
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	-0.2	3.0
Downlink budget for availability percentage of time			
C/N thermal for availability percentage of time, downlink	*dB*	*7.7*	*7.7*
C/N+I for availability percentage of time, downlink	*dB*	*7.6*	*7.6*
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0
Feeder link earth station characteristics			
Frequency	GHz	17.7	17.7
Maximum uplink power control			
Minimum feeder link earth station eirp	dBW	78.0	78.0
Latitude	°	39.7	39.7
Longitude	°	105.0	105.0
Altitude	km		
Rain climatic zone		E	E
Elevation angle	°	43.8	43.8
Rain attenuation for 99.97% of the time	dB	3.00	3.00
Rain attenuation for availability percentage of time	dB		
Characteristics of the space station receiver			
Satellite receive noise temperature	K	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2
Automatic gain control setting			
C/I due to other GSO BSS networks	dB	30.0	30.0
C/I from other assignments in the Plan	dB		
C/I from other GSO FSS systems	dB	30.0	30.0
Uplink budget			
Atmospheric absorption	*dB*	*0.5*	*0.5*
Slant path	*km*	*38500*	*38500*
Free space loss	*dB*	*209.1*	*209.1*
C/N thermal clear sky	*dB*	*27.5*	*27.5*
C/N+I clear sky	dB	24.2	24.2
C/N thermal uplink for 99.97% of the time	dB		
C/N+I uplink for 99.97% of the time	dB		
Available clear sky uplink rain margin above threshold	dB		

Footnote 1: For US-GSO D5, rain effects are not relevant.
Footnote 2: See the antenna gain pattern mask in attachment 1 to document 4-9-11/165
Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

BSS Assignment characteristics	Units	Canada CAN-3	Canada CAN-4	Canada CAN-5	Canada CAN-7	Canada CAN-8	Canada CAN-9	Canada CAN-10	Canada CAN-11	Canada CAN-12
System Characteristics										
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%	99.6890	99.7200	99.7040	99.7390	99.7540	99.7170	99.7010	99.7400	99.7380
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.6890	99.7200	99.7040	99.7390	99.7540	99.7170	99.7010	99.7400	99.7380
Calculated availability due to rain downlink (Rec P 618-5)	%	99.6950	99.7260	99.7100	99.7450	99.7600	99.7230	99.7070	99.7460	99.7440
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	22.6	21.9	21.9	22.2	23.4	18.7	22.2	20.6	15.4
C/I due to GSO FSS networks	dB	50	50	50	50	50	50	50	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB									
Total Clear sky C/N+I margin above operating threshold (1)	dB	2.8	3.1	1.4	3.2	2.3	1.4	1.3	1.6	5.0
Available clear sky downlink rain margin above threshold	dB	2.9	3.2	1.4	3.3	2.3	1.4	1.4	1.7	5.2
Available clear sky uplink rain margin above threshold	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
C/N+I total link for 99.7% of the time	dB	6.6	6.8	6.6	6.9	7.0	6.7	6.6	6.8	7.1
C/N+I margin above operating threshold for 99.7% of the time	dB									
C/N+I total link margin above operating threshold for 99.7% of the time	dB	0.0	0.2	0.0	0.3	0.4	0.1	0.0	0.2	0.5
Space station characteristics										
Longitude	°	-82	-82	-82	-82	-82	-82	-82	-82	-82
Satellite e.i.r.p. in the direction of the earth station	dBW	48.4	48.8	44.5	48.9	47.9	44.6	44.5	47.4	46.7
Earth station characteristics										
Receive antenna diameter	cm	45	45	60	45	45	60	60	45	90
Receive antenna efficiency	%	65	65	65	65	65	65	65	65	64
On-axis antenna gain at receiver input	dBi									
On-axis antenna gain at antenna output	**dBi**	33.50	33.50	36.00	33.50	33.50	36.00	36.00	33.50	39.50
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K									
Clear sky receive system noise temperature at antenna output	K	123	123	123	123	123	123	123	123	123
Clear sky G/T	dB/K	12.6	12.6	15.1	12.6	12.6	15.1	15.1	12.6	18.6
Total pointing loss	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Location of earth station										
Latitude	°	**42.27**	**39.62**	**39.72**	**40.72**	**45.50**	**31.75**	**40.75**	**36.10**	**25.45**
Longitude	°	**-82.96**	**-75.12**	**-105.02**	**-74.02**	**-73.60**	**-106.48**	**-111.92**	**-115.10**	**-80.15**
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D2	D2	B	D2	D1	F	F	F	E
Elevation angle	°	41.2	43.6	38.2	42.2	37.0	44.5	33.8	35.5	60.2
Propagation characteristics										
Slant path	km	37690	37512	37917	37614	38020	37446	38280	38137	36511
Free space loss	dB	205.9	205.9	206.0	205.9	206.0	205.8	206.0	206.0	205.6
Atmospheric absorption	dB	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Rain attenuation for 99.7% of the time	dB	1.13	1.21	0.49	1.19	0.70	0.50	0.46	0.55	3.03
Noise increase due to rain for 99.7 % of the time	dB	1.87	1.96	0.97	1.94	1.30	0.99	0.92	1.07	3.38
Wanted pfd received at earth station	dB(W/m2)	-115.4	*-115.1*	*-118.8*	*-115.0*	*-115.6*	*-118.6*	*-118.8*	*-116.0*	*-118.8*
Rain attenuation for availability percentage of time	dB	1.11	1.30	0.50	1.35	0.85	0.54	0.47	0.64	3.44
Noise increase due to rain for availability percentage of time	dB	1.9	2.1	1.0	2.1	1.5	1.1	0.9	1.2	3.6

BSS Assignment characteristics	Units	Canada CAN-3	Canada CAN-4	Canada CAN-5	Canada CAN-7	Canada CAN-8	Canada CAN-9	Canada CAN-10	Canada CAN-11	Canada CAN-12
Downlink budget clear sky										
C/N thermal clear sky downlink	dB	9.7	10.1	8.2	10.2	9.1	8.4	8.1	8.6	14.3
C/N+I clear sky downlink	dB	9.5	9.8	8.0	9.9	8.9	8.0	8.0	8.3	11.8
C/N+I clear sky total link	dB	9.4	9.7	8.0	9.8	8.9	8.0	7.9	8.2	11.6
Clear sky C/N downlink margin above operating threshold	dB	3.1	3.5	1.6	3.6	2.5	1.8	1.5	2.0	7.7
Clear sky C/N+I downlink margin above operating threshold	dB	2.9	3.2	1.4	3.3	2.3	1.4	1.4	1.7	5.2
Clear sky C/N+I total margin above operating threshold	dB	2.8	3.1	1.4	3.2	2.3	1.4	1.3	1.6	5.0
Downlink budget 99.7% of the time										
C/N thermal for 99.7% of the time, downlink	dB	6.7	6.9	6.8	7.1	7.1	6.9	6.8	7.0	7.8
C/N+I for 99.7% of the time, downlink	dB	6.6	6.8	6.6	6.9	7.0	6.7	6.6	6.8	7.1
C/N margin above operating threshold for 99.7% of the time, downlink	dB	0.1	0.3	0.2	0.5	0.5	0.3	0.2	0.4	1.2
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	0.0	0.2	0.0	0.3	0.4	0.1	0.0	0.2	0.5
Downlink budget for availability percentage of time										
C/N thermal for availability percentage of time, downlink	dB	6.71	6.76	6.74	6.73	6.74	6.84	6.74	6.72	7.23
C/N+I for availability percentage of time, downlink	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.6
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics										
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4
Longitude	°	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D1	D1	D1	D1	D1	D1	D1
Elevation angle	°	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9
Rain attenuation for 99.97% of the time	dB	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Rain attenuation for availability percentage of time	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Characteristics of the space station receiver										
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control range	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I due to other assignments in the Plan										
C/I from other GSO FSS systems	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Uplink budget										
Atmospheric absorption	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Slant path	km	37788	37788	37788	37788	37788	37788	37788	37788	37788
Free space loss	dB	208.9	208.9	208.9	208.9	208.9	208.9	208.9	208.9	208.9
C/N thermal clear sky	dB	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
C/N+I clear sky	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
C/N+I uplink for 99.97% of the time	dB	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
Margin for 99.97% of the time	dB	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

BSS Assignment characteristics	Units	Canada CAN-13	Canada CAN-14	Canada CAN-15	Canada CAN-18	Canada CAN-20	Canada CAN-24	Canada CAN-25	Canada CAN-26	Canada CAN-28
System Characteristics										
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%	99.7980	99.8000	99.7230	99.7710	99.8550	99.8720	99.8370	99.8690	99.8560
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.7980	99.8000	99.7230	99.7710	99.8550	99.8720	99.8370	99.8690	99.8560
Calculated availability due to rain downlink (Rec P 618-5)	%	99.8040	99.8060	99.7290	99.7770	99.8610	99.8780	99.8430	99.8750	99.8620
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	23.4	23.0	17.8	21.1	23.7	23.2	22.5	19.7	23.7
C/I due to GSO FSS networks	dB	50	50	50	50	50	50	50	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB									
Total Clear sky C/N+I margin above operating threshold (1)	dB	2.5	2.7	5.6	3.0	3.7	3.7	4.2	2.9	3.3
Available clear sky downlink rain margin above threshold	dB	2.6	2.8	5.8	3.1	3.8	3.8	4.4	3.0	3.5
Available clear sky uplink rain margin above threshold	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
C/N+I total link for 99.7% of the time	dB	7.3	7.4	7.0	7.1	8.2	8.3	8.1	8.0	8.0
C/N+I margin above operating threshold for 99.7% of the time	dB									
C/N+I total link margin above operating threshold for 99.7% of the time	dB	0.7	0.8	0.4	0.5	1.6	1.7	1.5	1.4	1.4
Space station characteristics										
Longitude	°	-82	-82	-82	-82	-82	-82	-82	-82	-82
Satellite e.i.r.p. in the direction of the earth station	dBW	48.2	48.3	46.4	46.5	47.1	47	47.5	46.4	47.2
Earth station characteristics										
Receive antenna diameter	cm	45	45	90	60	60	60	60	60	60
Receive antenna efficiency	%	65	65	64	65	65	65	65	65	65
On-axis antenna gain at receiver input	dBi									
On-axis antenna gain at antenna output	**dBi**	33.50	33.50	39.50	36.00	36.00	36.00	36.00	36.00	36.00
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K									
Clear sky receive system noise temperature at antenna output	K	123	123	123	123	123	123	123	123	135
Clear sky G/T	dB/K	12.6	12.6	18.6	15.1	15.1	15.1	15.1	15.1	14.7
Total pointing loss	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Location of earth station										
Latitude	°	**45.42**	**43.65**	**29.95**	**37.50**	**47.57**	**44.65**	**41.88**	**34.05**	**47.35**
Longitude	°	**-75.70**	**-79.38**	**-90.12**	**-122.22**	**-52.72**	**-63.60**	**-87.63**	**-118.15**	**-122.20**
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	E	C	D1	D1	D2	F	C
Elevation angle	°	37.3	39.6	54.0	29.7	28.4	35.4	41.3	34.9	23.2
Propagation characteristics										
Slant path	km	37990	37812	36839	38635	38755	38150	37682	38192	39245
Free space loss	dB	206.0	205.9	205.7	206.1	206.1	206.0	205.9	206.0	206.3
Atmospheric absorption	dB	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Rain attenuation for 99.7% of the time	dB	0.70	0.73	3.09	1.04	0.84	0.78	1.15	0.62	0.81
Noise increase due to rain for 99.7 % of the time	dB	1.30	1.35	3.42	1.76	1.50	1.42	1.89	1.18	1.36
Wanted pfd received at earth station	dB(W/m2)	*-115.3*	*-115.2*	*-119.2*	*-117.5*	*-116.7*	*-116.6*	*-116.4*	*-117.1*	*-116.7*
Rain attenuation for availability percentage of time	dB	1.00	1.04	3.35	1.27	1.57	1.60	1.90	1.27	1.47
Noise increase due to rain for availability percentage of time	dB	1.7	1.8	3.5	2.0	2.3	2.4	2.6	2.0	2.1

		Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada
BSS Assignment characteristics	**Units**	**CAN-13**	**CAN-14**	**CAN-15**	**CAN-18**	**CAN-20**	**CAN-24**	**CAN-25**	**CAN-26**	**CAN-28**
Downlink budget clear sky										
C/N thermal clear sky downlink	dB	9.4	9.6	13.9	10.1	10.6	10.7	11.3	10.1	10.3
C/N+I clear sky downlink	dB	9.2	9.4	12.4	9.7	10.4	10.4	11.0	9.6	10.1
C/N+I clear sky total link	dB	9.1	9.3	12.2	9.6	10.3	10.3	10.8	9.5	9.9
Clear sky C/N downlink margin above operating threshold	dB	2.8	3.0	7.3	3.5	4.0	4.1	4.7	3.5	3.7
Clear sky C/N+I downlink margin above operating threshold	dB	2.6	2.8	5.8	3.1	3.8	3.8	4.4	3.0	3.5
Clear sky C/N+I total margin above operating threshold	dB	2.5	2.7	5.6	3.0	3.7	3.7	4.2	2.9	3.3
Downlink budget 99.7% of the time										
C/N thermal for 99.7% of the time, downlink	dB	7.4	7.5	7.4	7.3	8.3	8.5	8.2	8.3	8.1
C/N+I for 99.7% of the time, downlink	dB	7.3	7.4	7.0	7.1	8.2	8.3	8.1	8.0	8.0
C/N margin above operating threshold for 99.7% of the time, downlink	dB	0.8	0.9	0.8	0.7	1.7	1.9	1.6	1.7	1.5
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	0.7	0.8	0.4	0.5	1.6	1.7	1.5	1.4	1.4
Downlink budget for availability percentage of time										
C/N thermal for availability percentage of time, downlink	dB	6.70	6.75	6.98	6.76	6.73	6.71	6.75	6.76	6.69
C/N+I for availability percentage of time, downlink	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.1	0.4	0.2	0.1	0.1	0.2	0.2	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics										
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4
Longitude	°	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D1	D1	D1	D1	D1	D1	D1
Elevation angle	°	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9	39.9
Rain attenuation for 99.97% of the time	dB	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Rain attenuation for availability percentage of time	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Characteristics of the space station receiver										
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control range	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I due to other assignments in the Plan										
C/I from other GSO FSS systems	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Uplink budget										
Atmospheric absorption	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Slant path	km	37788	37788	37788	37788	37788	37788	37788	37788	37788
Free space loss	dB	208.9	208.9	208.9	208.9	208.9	208.9	208.9	208.9	208.9
C/N thermal clear sky	dB	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
C/N+I clear sky	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
C/N+I uplink for 99.97% of the time	dB	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
Margin for 99.97% of the time	dB	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

		Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada
BSS Assignment characteristics	**Units**	**CAN-30**	**CAN-32**	**CAN-34**	**CAN-35**	**CAN-38**	**CAN-39**	**CAN-46**	**CAN-47**	**CAN-48**
System Characteristics										
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%	99.8890	99.8690	99.8780	99.8460	99.8940	99.8790	99.6890	99.6930	99.7600
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.8890	99.8690	99.8780	99.8460	99.8940	99.8790	99.6890	99.6930	99.7600
Calculated availability due to rain downlink (Rec P 618-5)	%	99.8950	99.8750	99.8840	99.8520	99.9000	99.8850	99.6950	99.6990	99.7660
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	19.4	22.8	22.6	19.5	23.3	21.5	22.6	21.9	21.9
C/I due to GSO FSS networks	dB	50	50	50	50	50	50	50	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB									
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.0	4.7	5.0	6.0	3.9	5.1	2.8	3.1	1.4
Available clear sky downlink rain margin above threshold	dB	3.1	4.8	5.2	6.2	4.1	5.2	2.9	3.2	1.5
Available clear sky uplink rain margin above threshold	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
C/N+I total link for 99.7% of the time	dB	8.2	8.6	8.9	8.7	8.7	8.9	6.6	6.6	6.9
C/N+I margin above operating threshold for 99.7% of the time	dB									
C/N+I total link margin above operating threshold for 99.7% of the time	dB	1.6	2.0	2.3	2.1	2.1	2.3	0.0	0.0	0.3
Space station characteristics										
Longitude	°	-82	-82	-82	-82	-82	-82	-91	-91	-91
Satellite e.i.r.p. in the direction of the earth station	dBW	46.4	48	48.4	49.9	47.2	48.5	48.4	48.8	44.5
Earth station characteristics										
Receive antenna diameter	cm	60	60	60	60	60	60	45	45	60
Receive antenna efficiency	%	65	65	65	65	65	65	65	65	65
On-axis antenna gain at receiver input	dBi									
On-axis antenna gain at antenna output	**dBi**	36.00	36.00	36.00	36.00	36.00	36.00	33.50	33.50	36.00
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K									
Clear sky receive system noise temperature at antenna output	K	123	123	123	123	123	123	123	123	123
Clear sky G/T	dB/K	15.1	15.1	15.1	15.1	15.1	15.1	12.6	12.6	15.1
Total pointing loss	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Location of earth station										
Latitude	°	**33.30**	**42.83**	**42.20**	**33.45**	**44.98**	**38.51**	**42.27**	**39.62**	**39.72**
Longitude	°	**-112.02**	**-83.08**	**-71.07**	**-84.23**	**-93.15**	**-77.00**	**-82.96**	**-75.12**	**-105.02**
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		F	D2	D2	D3	D1	D2	D2	D2	B
Elevation angle	°	39.7	40.6	40.0	51.0	37.0	45.1	40.5	41.3	41.8
Propagation characteristics										
Slant path	km	37805	37737	37779	37014	38016	37406	37741	37683	37644
Free space loss	dB	205.9	205.9	205.9	205.7	206.0	205.8	205.9	205.9	205.9
Atmospheric absorption	dB	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Rain attenuation for 99.7% of the time	dB	0.54	1.11	1.17	2.05	0.73	1.23	1.13	1.28	0.43
Noise increase due to rain for 99.7 % of the time	dB	1.05	1.85	1.92	2.75	1.35	1.99	1.87	2.04	0.87
Wanted pfd received at earth station	dB(W/m2)	*-116.9*	*-115.8*	*-115.5*	*-114.7*	*-116.3*	*-115.4*	*-115.5*	*-115.2*	*-118.6*
Rain attenuation for availability percentage of time	dB	1.30	2.20	2.40	3.40	1.75	2.50	1.13	1.28	0.53
Noise increase due to rain for availability percentage of time	dB	2.1	2.9	3.0	3.6	2.5	3.1	1.9	2.1	1.0

BSS Assignment characteristics	Units	Canada CAN-30	Canada CAN-32	Canada CAN-34	Canada CAN-35	Canada CAN-38	Canada CAN-39	Canada CAN-46	Canada CAN-47	Canada CAN-48
Downlink budget clear sky										
C/N thermal clear sky downlink	dB	10.2	11.8	12.2	13.8	10.9	12.3	9.7	10.1	8.3
C/N+I clear sky downlink	dB	9.7	11.4	11.8	12.8	10.7	11.8	9.5	9.8	8.1
C/N+I clear sky total link	dB	9.6	11.3	11.6	12.6	10.5	11.7	9.4	9.7	8.0
Clear sky C/N downlink margin above operating threshold	dB	3.6	5.2	5.6	7.2	4.3	5.7	3.1	3.5	1.7
Clear sky C/N+I downlink margin above operating threshold	dB	3.1	4.8	5.2	6.2	4.1	5.2	2.9	3.2	1.5
Clear sky C/N+I total margin above operating threshold	dB	3.0	4.7	5.0	6.0	3.9	5.1	2.8	3.1	1.4
Downlink budget 99.7% of the time										
C/N thermal for 99.7% of the time, downlink	dB	8.6	8.8	9.1	9.0	8.8	9.1	6.7	6.8	7.0
C/N+I for 99.7% of the time, downlink	dB	8.2	8.6	8.9	8.7	8.7	8.9	6.6	6.6	6.9
C/N margin above operating threshold for 99.7% of the time, downlink	dB	2.0	2.2	2.5	2.4	2.2	2.5	0.1	0.2	0.4
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	1.6	2.0	2.3	2.1	2.1	2.3	0.0	0.0	0.3
Downlink budget for availability percentage of time										
C/N thermal for availability percentage of time, downlink	dB	6.79	6.70	6.75	6.87	6.65	6.77	6.67	6.70	6.72
C/N+I for availability percentage of time, downlink	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.2	0.1	0.2	0.3	0.1	0.2	0.1	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics										
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4
Longitude	°	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D1	D1	D1	D1	D1	D1	D1
Elevation angle	°	39.9	39.9	39.9	39.9	39.9	39.9	38.6	38.6	38.6
Rain attenuation for 99.97% of the time	dB	8.2	8.2	8.2	8.2	8.2	8.2	8.4	8.4	8.4
Rain attenuation for availability percentage of time	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Characteristics of the space station receiver										
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control range	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I due to other assignments in the Plan										
C/I from other GSO FSS systems	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Uplink budget										
Atmospheric absorption	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Slant path	km	37788	37788	37788	37788	37788	37788	37889	37889	37889
Free space loss	dB	208.9	208.9	208.9	208.9	208.9	208.9	209.0	209.0	209.0
C/N thermal clear sky	dB	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
C/N+I clear sky	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.5	19.5	19.5	19.5	19.5	19.5	19.3	19.3	19.3
C/N+I uplink for 99.97% of the time	dB	19.2	19.2	19.2	19.2	19.2	19.2	19.0	19.0	19.0
Margin for 99.97% of the time	dB	12.6	12.6	12.6	12.6	12.6	12.6	12.4	12.4	12.4

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

BSS Assignment characteristics	Units	Canada CAN-50	Canada CAN-51	Canada CAN-52	Canada CAN-53	Canada CAN-54	Canada CAN-55	Canada CAN-56	Canada CAN-57	Canada CAN-58	Canada CAN-61
System Characteristics											
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%	99.7180	99.7340	99.7580	99.7600	99.7840	99.7270	99.7840	99.7910	99.7280	99.8390
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.7180	99.7340	99.7580	99.7600	99.7840	99.7270	99.7840	99.7910	99.7280	99.8390
Calculated availability due to rain downlink (Rec P 618-5)	%	99.7240	99.7400	99.7640	99.7660	99.7900	99.7330	99.7900	99.7970	99.7340	99.8450
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	22.2	23.4	18.7	22.2	20.6	15.4	23.4	23.0	17.8	21.1
C/I due to GSO FSS networks	dB	50	50	50	50	50	50	50	50	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB										
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.2	2.2	1.4	1.4	1.7	5.0	2.5	2.6	5.6	3.1
Available clear sky downlink rain margin above threshold	dB	3.3	2.3	1.5	1.5	1.8	5.2	2.6	2.7	5.8	3.2
Available clear sky uplink rain margin above threshold	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
C/N+I total link for 99.7% of the time	dB	6.7	6.8	6.9	6.9	7.1	7.0	7.2	7.3	7.1	7.6
C/N+I margin above operating threshold for 99.7% of the time	dB										
C/N+I total link margin above operating threshold for 99.7% of the time	dB	0.1	0.2	0.3	0.3	0.5	0.4	0.6	0.7	0.5	1.0
Space station characteristics											
Longitude	°	-91	-91	-91	-91	-91	-91	-91	-91	-91	-91
Satellite e.i.r.p. in the direction of the earth station	dBW	48.9	47.9	44.6	44.5	47.4	46.7	48.2	48.3	46.4	46.5
Earth station characteristics											
Receive antenna diameter	cm	45	45	60	60	45	90	45	45	90	60
Receive antenna efficiency	%	65	65	65	65	65	64	65	65	64	65
On-axis antenna gain at receiver input	dBi										
On-axis antenna gain at antenna output	**dBi**	33.50	33.50	36.00	36.00	33.50	39.50	33.50	33.50	39.50	36.00
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K										
Clear sky receive system noise temperature at antenna output	K	123	123	123	123	123	123	123	123	123	123
Clear sky G/T	dB/K	12.6	12.6	15.1	15.1	12.6	18.6	12.6	12.6	18.6	15.1
Total pointing loss	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Location of earth station											
Latitude	°	**40.72**	**45.50**	**31.75**	**40.75**	**36.10**	**25.45**	**45.42**	**43.65**	**29.95**	**37.50**
Longitude	°	**-74.02**	**-73.60**	**-106.48**	**-111.92**	**-115.10**	**-80.15**	**-75.70**	**-79.38**	**-90.12**	**-122.22**
Altitude	km	0	0	0	0	0	0	0	0	0	0
Rain climatic zone		D2	D1	F	F	F	E	D1	D1	E	C
Elevation angle	°	39.8	34.8	49.4	38.2	41.0	57.9	35.5	38.3	55.1	35.7
Propagation characteristics											
Slant path	km	37797	38194	37118	37920	37707	36627	38136	37912	36777	38126
Free space loss	dB	205.9	206.0	205.8	206.0	205.9	205.7	206.0	206.0	205.7	206.0
Atmospheric absorption	dB	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Rain attenuation for 99.7% of the time	dB	1.27	0.76	0.43	0.39	0.46	3.14	0.74	0.76	3.04	0.85
Noise increase due to rain for 99.7 % of the time	dB	2.03	1.39	0.87	0.80	0.92	3.44	1.36	1.39	3.39	1.52
Wanted pfd received at earth station	dB(W/m2)	*-115.1*	*-115.7*	*-118.4*	*-118.7*	*-115.8*	*-118.9*	*-115.4*	*-115.2*	*-119.1*	*-117.2*
Rain attenuation for availability percentage of time	dB	1.35	0.85	0.54	0.50	0.64	3.44	1.00	1.04	3.35	1.34
Noise increase due to rain for availability percentage of time	dB	2.1	1.5	1.1	1.0	1.2	3.6	1.7	1.8	3.5	2.1

		Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada
BSS Assignment characteristics	**Units**	**CAN-50**	**CAN-51**	**CAN-52**	**CAN-53**	**CAN-54**	**CAN-55**	**CAN-56**	**CAN-57**	**CAN-58**	**CAN-61**
Downlink budget clear sky											
C/N thermal clear sky downlink	dB	10.2	9.1	8.5	8.2	8.7	14.2	9.4	9.5	13.9	10.2
C/N+I clear sky downlink	dB	9.9	8.9	8.1	8.1	8.4	11.8	9.2	9.3	12.4	9.8
C/N+I clear sky total link	dB	9.8	8.8	8.0	8.0	8.3	11.6	9.1	9.2	12.2	9.7
Clear sky C/N downlink margin above operating threshold	dB	3.6	2.5	1.9	1.6	2.1	7.6	2.8	2.9	7.3	3.6
Clear sky C/N+I downlink margin above operating threshold	dB	3.3	2.3	1.5	1.5	1.8	5.2	2.6	2.7	5.8	3.2
Clear sky C/N+I total margin above operating threshold	dB	3.2	2.2	1.4	1.4	1.7	5.0	2.5	2.6	5.6	3.1
Downlink budget 99.7% of the time											
C/N thermal for 99.7% of the time, downlink	dB	6.9	6.9	7.2	7.0	7.3	7.6	7.3	7.4	7.5	7.8
C/N+I for 99.7% of the time, downlink	dB	6.7	6.8	6.9	6.9	7.1	7.0	7.2	7.3	7.1	7.6
C/N margin above operating threshold for 99.7% of the time, downlink	dB	0.3	0.3	0.6	0.4	0.7	1.0	0.7	0.8	0.9	1.2
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	0.1	0.2	0.3	0.3	0.5	0.4	0.6	0.7	0.5	1.0
Downlink budget for availability percentage of time											
C/N thermal for availability percentage of time, downlink	dB	6.69	6.70	6.92	6.74	6.82	7.20	6.67	6.73	7.00	6.73
C/N+I for availability percentage of time, downlink	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.1	0.3	0.1	0.2	0.6	0.1	0.1	0.4	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics											
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4
Longitude	°	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2
Altitude	km	0	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D1	D1	D1	D1	D1	D1	D1	D1
Elevation angle	°	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6
Rain attenuation for 99.97% of the time	dB	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Rain attenuation for availability percentage of time	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Characteristics of the space station receiver											
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control range	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I due to other assignments in the Plan											
C/I from other GSO FSS systems	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Uplink budget											
Atmospheric absorption	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Slant path	km	37889	37889	37889	37889	37889	37889	37889	37889	37889	37889
Free space loss	dB	209.0	209.0	209.0	209.0	209.0	209.0	209.0	209.0	209.0	209.0
C/N thermal clear sky	dB	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
C/N+I clear sky	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
C/N+I uplink for 99.97% of the time	dB	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Margin for 99.97% of the time	dB	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

		Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada
BSS Assignment characteristics	**Units**	**CAN-63**	**CAN-67**	**CAN-68**	**CAN-69**	**CAN-71**	**CAN-73**	**CAN-75**	**CAN-77**	**CAN-78**
System Characteristics										
Frequency	GHz	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500	12.500
Availability objective	%	99.8170	99.8470	99.8380	99.8970	99.8890	99.9060	99.8670	99.8670	99.8440
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.8170	99.8470	99.8380	99.8970	99.8890	99.9060	99.8670	99.8670	99.8440
Calculated availability due to rain downlink (Rec P 618-5)	%	99.8230	99.8530	99.8440	99.9030	99.8950	99.9120	99.8730	99.8730	99.8500
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24	24	24	24	24	24	24	24
Modulation type		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
C/I due to other GSO BSS networks	dB	23.7	23.2	22.5	19.7	23.7	19.4	22.8	22.6	19.5
C/I due to GSO FSS networks	dB	50	50	50	50	50	50	50	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB									
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.6	3.6	4.2	3.0	3.4	3.0	4.7	5.0	6.0
Available clear sky downlink rain margin above threshold	dB	3.7	3.8	4.4	3.1	3.5	3.1	4.8	5.1	6.2
Available clear sky uplink rain margin above threshold	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
C/N+I total link for 99.7% of the time	dB	7.7	8.0	8.1	8.4	8.4	8.5	8.6	8.7	8.6
C/N+I margin above operating threshold for 99.7% of the time	dB									
C/N+I total link margin above operating threshold for 99.7% of the time	dB	1.1	1.4	1.5	1.8	1.8	1.9	2.0	2.1	2.0
Space station characteristics										
Longitude	°	-91	-91	-91	-91	-91	-91	-91	-91	-91
Satellite e.i.r.p. in the direction of the earth station	dBW	47.1	47	47.5	46.4	47.2	46.4	48	48.4	49.9
Earth station characteristics										
Receive antenna diameter	cm	60	60	60	60	60	60	60	60	60
Receive antenna efficiency	%	65	65	65	65	65	65	65	65	65
On-axis antenna gain at receiver input	dBi									
On-axis antenna gain at antenna output	**dBi**	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Off-axis antenna gain characteristics		Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K									
Clear sky receive system noise temperature at antenna output	K	123	123	123	123	135	123	123	123	123
Clear sky G/T	dB/K	15.1	15.1	15.1	15.1	14.7	15.1	15.1	15.1	15.1
Total pointing loss	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Location of earth station										
Latitude	°	**47.57**	**44.65**	**41.88**	**34.05**	**47.35**	**33.30**	**42.83**	**42.20**	**33.45**
Longitude	°	**-52.72**	**-63.60**	**-87.63**	**-118.15**	**-122.20**	**-112.02**	**-83.08**	**-71.07**	**-84.23**
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D2	F	C	F	D2	D2	D3
Elevation angle	°	24.0	31.8	41.5	40.9	27.7	45.2	39.9	37.2	50.4
Propagation characteristics										
Slant path	km	39162	38455	37666	37709	38817	37401	37786	37999	37052
Free space loss	dB	206.2	206.1	205.9	205.9	206.2	205.8	205.9	206.0	205.8
Atmospheric absorption	dB	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Rain attenuation for 99.7% of the time	dB	1.01	0.89	1.14	0.50	0.66	0.46	1.13	1.26	2.08
Noise increase due to rain for 99.7 % of the time	dB	1.72	1.57	1.88	0.99	1.15	0.92	1.87	2.02	2.77
Wanted pfd received at earth station	dB(W/m2)	*-117.0*	*-116.8*	*-116.4*	*-116.8*	*-116.4*	*-116.7*	*-115.9*	*-115.6*	*-114.7*
Rain attenuation for availability percentage of time	dB	1.54	1.55	1.90	1.30	1.50	1.30	2.20	2.40	3.40
Noise increase due to rain for availability percentage of time	dB	2.3	2.3	2.6	2.1	2.1	2.1	2.9	3.0	3.6

BSS Assignment characteristics	Units	Canada CAN-63	Canada CAN-67	Canada CAN-68	Canada CAN-69	Canada CAN-71	Canada CAN-73	Canada CAN-75	Canada CAN-77	Canada CAN-78
Downlink budget clear sky										
C/N thermal clear sky downlink	dB	10.5	10.6	11.3	10.2	10.3	10.2	11.8	12.1	13.8
C/N+I clear sky downlink	dB	10.3	10.4	11.0	9.7	10.1	9.7	11.4	11.7	12.8
C/N+I clear sky total link	dB	10.2	10.2	10.8	9.6	10.0	9.6	11.3	11.6	12.6
Clear sky C/N downlink margin above operating threshold	dB	3.9	4.0	4.7	3.6	3.7	3.6	5.2	5.5	7.2
Clear sky C/N+I downlink margin above operating threshold	dB	3.7	3.8	4.4	3.1	3.5	3.1	4.8	5.1	6.2
Clear sky C/N+I total margin above operating threshold	dB	3.6	3.6	4.2	3.0	3.4	3.0	4.7	5.0	6.0
Downlink budget 99.7% of the time										
C/N thermal for 99.7% of the time, downlink	dB	7.8	8.1	8.3	8.7	8.5	8.9	8.8	8.8	9.0
C/N+I for 99.7% of the time, downlink	dB	7.7	8.0	8.1	8.4	8.4	8.5	8.6	8.7	8.6
C/N margin above operating threshold for 99.7% of the time, downlink	dB	1.2	1.5	1.7	2.1	1.9	2.3	2.2	2.2	2.4
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	1.1	1.4	1.5	1.8	1.8	1.9	2.0	2.1	2.0
Downlink budget for availability percentage of time										
C/N thermal for availability percentage of time, downlink	dB	6.70	6.74	6.75	6.81	6.73	6.88	6.69	6.70	6.86
C/N+I for availability percentage of time, downlink	dB	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.3
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station characteristics										
Frequency	GHz	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Maximum uplink power control		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0
Latitude	°	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4	43.4
Longitude	°	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2	-79.2
Altitude	km	0	0	0	0	0	0	0	0	0
Rain climatic zone		D1	D1	D1	D1	D1	D1	D1	D1	D1
Elevation angle	°	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6
Rain attenuation for 99.97% of the time	dB	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Rain attenuation for availability percentage of time	dB	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1
Characteristics of the space station receiver										
Satellite receive noise temperature	K	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Automatic gain control range	dB	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
C/I due to other assignments in the Plan										
C/I from other GSO FSS systems	dB	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Uplink budget										
Atmospheric absorption	dB	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Slant path	km	37889	37889	37889	37889	37889	37889	37889	37889	37889
Free space loss	dB	209.0	209.0	209.0	209.0	209.0	209.0	209.0	209.0	209.0
C/N thermal clear sky	dB	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
C/N+I clear sky	dB	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3
C/N+I uplink for 99.97% of the time	dB	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Margin for 99.97% of the time	dB	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25

BSS Assignment characteristics	Units	Canada CAN-81	Canada CAN-82
System Characteristics			
Frequency	GHz	12.500	12.500
Availability objective	%	99.8980	99.8730
Calculated availability due to rain up and downlink (Rec P 618-5)	%	99.8980	99.8730
Calculated availability due to rain downlink (Rec P 618-5)	%	99.9040	99.8790
Calculated availability due to rain uplink (Rec P 618-5)	%	99.9940	99.9940
Receiver noise Bandwidth	MHz	24	24
Modulation type		QPSK	QPSK
C/I due to other GSO BSS networks	dB	23.3	21.5
C/I due to GSO FSS networks	dB	50	50
Clear sky feeder link C/N+I	dB	25.7	25.7
C/N+I required at operating threshold	dB	6.6	6.6
Clear sky C/N+I margin above operating threshold (1)	dB		
Total Clear sky C/N+I margin above operating threshold (1)	dB	3.9	5.0
Available clear sky downlink rain margin above threshold	dB	4.1	5.2
Available clear sky uplink rain margin above threshold	dB	19.1	19.1
C/N+I total link for 99.7% of the time	dB	8.8	8.7
C/N+I margin above operating threshold for 99.7% of the time	dB		
C/N+I total link margin above operating threshold for 99.7% of the time	dB	2.2	2.1
Space station characteristics			
Longitude	°	-91	-91
Satellite e.i.r.p. in the direction of the earth station	dBW	47.2	48.5
Earth station characteristics			
Receive antenna diameter	cm	60	60
Receive antenna efficiency	%	65	65
On-axis antenna gain at receiver input	dBi		
On-axis antenna gain at antenna output	**dBi**	36.00	36.00
Off-axis antenna gain characteristics		Footnote 3	Footnote 3
Clear sky receive system noise temperature at receiver input	K		
Clear sky receive system noise temperature at antenna output	K	123	123
Clear sky G/T	dB/K	15.1	15.1
Total pointing loss	dB	0.0	0.0
Location of earth station			
Latitude	°	**44.98**	**38.51**
Longitude	°	**-93.15**	**-77.00**
Altitude	km	0	0
Rain climatic zone		D1	D2
Elevation angle	°	38.1	43.1
Propagation characteristics			
Slant path	km	37925	37552
Free space loss	dB	206.0	205.9
Atmospheric absorption	dB	0.2	0.2
Rain attenuation for 99.7% of the time	dB	0.70	1.29
Noise increase due to rain for 99.7 % of the time	dB	1.30	2.05
Wanted pfd received at earth station	dB(W/m2)	*-116.3*	*-115.5*
Rain attenuation for availability percentage of time	dB	1.75	2.50
Noise increase due to rain for availability percentage of time	dB	2.5	3.1

BSS Assignment characteristics	Units	Canada CAN-81	Canada CAN-82
Downlink budget clear sky			
C/N thermal clear sky downlink	dB	10.9	12.3
C/N+I clear sky downlink	dB	10.7	11.8
C/N+I clear sky total link	dB	10.5	11.6
Clear sky C/N downlink margin above operating threshold	dB	4.3	5.7
Clear sky C/N+I downlink margin above operating threshold	dB	4.1	5.2
Clear sky C/N+I total margin above operating threshold	dB	3.9	5.0
Downlink budget 99.7% of the time			
C/N thermal for 99.7% of the time, downlink	dB	8.9	9.0
C/N+I for 99.7% of the time, downlink	dB	8.8	8.7
C/N margin above operating threshold for 99.7% of the time, downlink	dB	2.3	2.4
C/N+I margin above operating threshold for 99.7% of the time, downlink	dB	2.2	2.1
Downlink budget for availability percentage of time			
C/N thermal for availability percentage of time, downlink	dB	6.67	6.74
C/N+I for availability percentage of time, downlink	dB	6.6	6.6
C/N margin above operating threshold for availability percentage of the time, downlink	dB	0.1	0.1
C/N+I margin above operating threshold for availability percentage of the time,	dB	0.0	0.0
Feeder link earth station characteristics			
Frequency	GHz	17.7	17.7
Maximum uplink power control		0.0	0.0
Feeder link earth station eirp	dBW	78.0	78.0
Latitude	°	43.4	43.4
Longitude	°	-79.2	-79.2
Altitude	km	0	0
Rain climatic zone		D1	D1
Elevation angle	°	38.6	38.6
Rain attenuation for 99.97% of the time	dB	8.4	8.4
Rain attenuation for availability percentage of time	dB	19.1	19.1
Characteristics of the space station receiver			
Satellite receive noise temperature	K	616.6	616.6
Satellite receive antenna gain in the direction of the feeder link station	dB	32.2	32.2
Automatic gain control range	dB	10.0	10.0
C/I due to other GSO BSS networks	dB	30.0	30.0
C/I due to other assignments in the Plan			
C/I from other GSO FSS systems	dB	50.0	50.0
Uplink budget			
Atmospheric absorption	dB	0.4	0.4
Slant path	km	37889	37889
Free space loss	dB	209.0	209.0
C/N thermal clear sky	dB	27.7	27.7
C/N+I clear sky	dB	25.7	25.7
C/N thermal uplink for 99.97% of the time	dB	19.3	19.3
C/N+I uplink for 99.97% of the time	dB	19.0	19.0
Margin for 99.97% of the time	dB	12.4	12.4

Footnote 3: See "test results template" in Figure 4 of ITU Document 4-9-11/172-E, 25